

151385  
P. 70

# NASA Technical Memorandum

NASA TM - 108392

## FY 1992 SCIENTIFIC AND TECHNICAL REPORTS, ARTICLES, PAPERS, AND PRESENTATIONS

Compiled by Joyce E. Turner  
Management Operations Office

October 1992

(NASA-TM-108392) THE FY 1992  
SCIENTIFIC AND TECHNICAL REPORTS,  
ARTICLES, PAPERS, AND PRESENTATIONS  
(NASA) 70 p

N93-20920

Unclass

G3/82 0151385



National Aeronautics and  
Space Administration

George C. Marshall Space Flight Center



**REPORT DOCUMENTATION PAGE**Form Approved  
OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.

<b>1. AGENCY USE ONLY (Leave blank)</b>		<b>2. REPORT DATE</b> October 1992	<b>3. REPORT TYPE AND DATES COVERED</b> Technical Memorandum	
<b>4. TITLE AND SUBTITLE</b> FY 1992 Scientific and Technical Reports, Articles, Papers, and Presentations			<b>5. FUNDING NUMBERS</b>	
<b>6. AUTHOR(S)</b> Compiled by Joyce E. Turner				
<b>7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)</b> George C. Marshall Space Flight Center Marshall Space Flight Center, Alabama 35812			<b>8. PERFORMING ORGANIZATION REPORT NUMBER</b>	
<b>9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)</b> National Aeronautics and Space Administration Washington, DC 20546			<b>10. SPONSORING / MONITORING AGENCY REPORT NUMBER</b> NASA TM-108392	
<b>11. SUPPLEMENTARY NOTES</b> Prepared by Management Operations Office, Human Resources and Administrative Support				
<b>12a. DISTRIBUTION / AVAILABILITY STATEMENT</b> Unclassified — Unlimited			<b>12b. DISTRIBUTION CODE</b>	
<b>13. ABSTRACT (Maximum 200 words)</b>  This document presents formal NASA technical reports, papers published in technical journals, and presentations by MSFC personnel in FY92. It also includes papers of MSFC contractors.  After being announced in STAR, all of the NASA series reports may be obtained from the National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161.  The information in this report may be of value to the scientific and engineering community in determining what information has been published and what is available.				
<b>14. SUBJECT TERMS</b>			<b>15. NUMBER OF PAGES</b> 70	
			<b>16. PRICE CODE</b> NTIS	
<b>17. SECURITY CLASSIFICATION OF REPORT</b> Unclassified	<b>18. SECURITY CLASSIFICATION OF THIS PAGE</b> Unclassified	<b>19. SECURITY CLASSIFICATION OF ABSTRACT</b> Unclassified	<b>20. LIMITATION OF ABSTRACT</b> Unlimited	



## FOREWORD

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Since July 1, 1960, when the George C. Marshall Space Flight Center was organized, the reporting of scientific and engineering information has been considered a prime responsibility of the Center. Our credo has been that "research and development work is valuable, but only if its results can be communicated and made understandable to others."

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Marshall Space Flight Center, Alabama

FY 1992 SCIENTIFIC AND TECHNICAL REPORTS,  
ARTICLES, PAPERS, AND PRESENTATIONS

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TM-103555  
NASA Marshall Space Flight Center Solar  
Observatory Report—January to June 1991.  
J.E. Smith, Space Science Laboratory.  
October 1991  
N92-14958

This report provides a description of the NASA Marshall Space Flight Center's Solar Vector Magnetograph Facility and gives a summary of its observations and data reduction during January-June 1991. The systems that make up the facility are a magnetograph telescope, an H-alpha telescope, a Questar telescope, and a computer code.

TM-103556 November 1991  
Atmospheric Environment for Space Shuttle  
(STS-37) Launch. G.L. Jasper and G.W. Batts.  
Space Science Laboratory. N92-12375

This report presents a summary of selected atmospheric conditions observed near space shuttle STS-37 launch time on April 5, 1991, at Kennedy Space Center, FL. Values of ambient pressure, temperature, moisture, ground winds, visual observations (cloud), and winds aloft are included. The sequence of prelaunch Jimsphere-measured vertical wind profiles is given in this report. The final atmospheric tape, which consists of wind and thermodynamic parameters versus altitude, for STS-37 vehicle ascent has been constructed. The STS-37 ascent atmospheric data tape has been constructed by Marshall Space Flight Center's Earth Science and Applications Division to provide an internally consistent data set for use in postflight performance assessments and represents the best estimate of the launch environment to the 400,000-ft altitude that was traversed by the STS-37 vehicle.

TM-103557 December 1991  
High-Frequency Data Observations From Space Shuttle Main Engine Low-Pressure Fuel Turbopump Discharge Duct Flex Joint Tripod Failure Investigation. T.F. Zoladz and R.A. Farr. Structures and Dynamics Laboratory.  
N92-13279

This report summarizes observations made by MSFC Structures and Dynamics Laboratory engineers during their participation in the space shuttle main engine (SSME) low-pressure fuel turbopump discharge duct flex joint tripod failure investigation. New signal processing techniques used by the Component Assessment Branch and the Induced Environments Branch during the failure

investigation are described in detail. Moreover, nonlinear correlations between frequently encountered anomalous frequencies found in SSME dynamic data are discussed. Finally, the report concludes by recommending the continuation of low-pressure fuel (LPF) duct testing through laboratory flow simulations and MSFC-managed technology test bed (TTB) SSME testing.

TM-103558 December 1991  
 Characterization of the Effect of Boron Content  
 on Weld Cracking of Inconel 718 Type Alloys—  
 Center Director's Discretionary Fund Final  
 Report. R.G. Thompson, W.R. Gamwell, and  
 T.W. Malone. Materials and Processes Labora-  
 tory. X92-10214

Alloy 718 type compositions were studied to characterize the effect of boron content on their weld HAZ cracking. Alloy compositions studied were a combined subset of specimens from General Electric and University of Alabama at Birmingham studies. Microcrack data were available for all specimens used in this study. Differential thermal analyses, Gleeble thermal analysis, scanning auger microscopy, and microstructural evaluations were performed on all alloy compositions to investigate intergranular liquid formation and segregation behavior effects of boron.

Four alloy 718 type compositions were cast within the MSFC Materials and Processes Laboratory. Varestraint (weldability) testing was performed in an attempt to quantify the effect of boron on their hot cracking susceptibility.

Boron was found to increase microfissuring behavior in alloy 718 type compositions by its potency as a Laves former and by the resultant long solidification range that Laves-forming alloys have. It was found that carbon in large concentrations in these type alloys can significantly alter their solidification behavior and completely reverse the effect of a Laves former like boron.

TM-103559 December 1991  
The Effects of Multiple Repairs on Inconel 718  
Weld Mechanical Properties. C.K. Russell,  
A.C. Nunes, Jr., and D. Moore. Materials and  
Processes Laboratory. N92-14380

Inconel 718 weldments were repaired 3, 6, 9, and 13 times using the gas tungsten arc welding process. The welded panels were machined into mechanical test specimens, postweld heat treated, and nondestructively inspected. Tensile properties

and high-cycle fatigue life were evaluated and the results compared to unrepaired weld properties. Mechanical property data were analyzed using the statistical methods of difference in log means and Weibull analysis for high-cycle fatigue properties.

Statistical analysis performed on the data did not show a significant decrease in tensile or high-cycle fatigue properties due to the repeated repairs. Some degradation was observed in all properties; however, it was minimal.

TM-103560 June 1992  
National Launch System Cycle 1 Loads and Models Data Book. F. Bugg, J. Brunty, G. Ernsberger, D. McGhee, L. Gagliano, F. Harrington, D. Meyer, and E. Blades. Structures and Dynamics Laboratory. N92-30215

This document contains preliminary cycle 1 loads for the National Launch System NLS 1 and NLS 2 vehicles. The loads provided and recommended as design loads represent the maximum loads expected during prelaunch and flight regimes, i.e., limit loads, except that propellant tank ullage pressure has not been included. Ullage pressure should be added to the loads book values for cases where the addition results in higher loads. The loads must be multiplied by the appropriate factors of safety to determine the ultimate loads for which the structure must be capable.

TM-103561 December 1991  
No-Vent Fill Pressurization Tests Using a Cryogen Simulant. G.R. Schmidt, R.W. Carrigan, J.E. Hahs, D.A. Vaughan, and D.C. Foust. Propulsion Laboratory. N92-15354

This report describes the results of an experimental program which investigated the performance of various no-vent fill techniques for tank-to-tank liquid transfer. The tests were performed using a cryogen simulant (Freon-114) and a test-bed consisting of a multiple tank/plumbing network that enabled investigations of a variety of different inlet flow and active mixing regimes. Several results and conclusions were drawn from the 26 transfer experiments comprising the program. Most notable was the significant improvement in fill performance (i.e., minimized fill time and maximized fill fraction) with increased agitation of the liquid surface. Another was the close correlation between measured condensation rates and those predicted by recent theories which express condensation as a function of turbu-

lent eddy effects on the liquid surface. In most cases, test data exhibited strong agreement with an analytical model which accounts for tank heat transfer and thermodynamics in a 1-g environment.

TM-103562 December 1991  
Lunar Mission Aerobrake Performance Study. J. Mulqueen and D. Coughlin. Program Development Directorate and Systems Analysis and Integration Laboratory. N92-15079

Nine lunar mission scenarios were developed to show the transfer vehicle performance benefits of aerobraking into low-Earth orbit (LEO) upon Earth return as opposed to an all-propulsive maneuver. The initial mass in LEO (IMLEO) of the lunar transfer vehicle is considered the measure of vehicle performance. Four types of mission profiles in conjunction with two vehicle concepts were used to construct the scenarios. These nine scenarios were designed to represent a broad range of possible lunar missions so that a general knowledge base of aerobraking and lunar transfer vehicle performance levels could be obtained. Also discussed in this study are the mass sensitivities of each transfer vehicle to changes in the selected design parameters: ISP, crew module mass, payload to surface, and aerobrake mass fraction.

A parametric study was performed on two of the mission scenarios to help quantify the performance benefits by adding a set of drop tanks to the vehicle. The parametric study also provides partial derivatives which show the sensitivities of IMLEO to the four design parameters listed above. The last section of this report is a ranking of the mission scenarios based on vehicle performance.

The intent of this report is to present vehicle performance levels only. No consideration is given to the Earth-to-orbit vehicle, cost, or operational complexities such as rendezvous, aerobrake guidance, or contingencies.

TM-103563 December 1991  
Differential Thermal Analysis of Lunar Soil Simulant. D. Tucker and A. Setzer. Materials and Processes Laboratory. N92-15951

Differential thermal analysis of lunar soil simulant known as "Minnesota Lunar Simulant-1" (MLS-1) was performed. The MLS-1 was tested in the as-received form, in glass form, and with additional silica. The silica addition was seen to depress nucleation events which leads to a better glass former.



# NASA TECHNICAL MEMORANDUM

TM-103564 January 1992  
 Space Station *Freedom* Environmental Control and Life Support System Phase III Water Recovery Test Stages 1A, 2A, and 3A Final Report. R.M. Bagdikian, D.L. Carter, D.W. Holder, C.F. McGriff, M.C. Roman, M.S. Traweek, and W.R. Williams. Structures and Dynamics Laboratory. X92-10218

A series of tests has been conducted at the NASA Marshall Space Flight Center (MSFC) to evaluate the performance of a predevelopment water recovery system. Potable, hygiene, and urine reclamation systems were integrated with end-use equipment items and successfully operated in open and partially closed-loop modes, with man-in-the-loop, for a total of 28 days. Several significant subsystem physical anomalies were encountered during testing. Reclaimed potable and hygiene water generally met the current Space Station *Freedom* (S.S. *Freedom*) water quality specifications for inorganic and microbiological constituents, but exceeded the maximum allowable concentrations for total organic carbon (TOC). This report summarizes the test objectives, system design, test activities/protocols, significant results/anomalies, and major lessons learned.

TM-103565 December 1991  
 Single Wall Penetration Equations. K.B. Hayashida and J.H. Robinson. Structures and Dynamics Laboratory. N92-16682

This report compares five single plate penetration equations for accuracy and effectiveness. These five equations are two well-known equations (Fish-Summers and Schmidt-Holsapple), two equations developed for the Apollo project (Rockwell and Johnson Space Center (JSC)), and one recently revised from JSC (Cour-Palais). They were derived from test results, with velocities ranging up to 8 km/s. Microsoft Excel software was used to construct a spreadsheet to calculate the diameters and masses of projectiles for various velocities, varying the material properties of both projectile and target for the five single plate penetration equations. The results were plotted on diameter versus velocity graphs for ballistic and spallation limits using Cricket Graph software, for velocities ranging from 2 to 15 km/s defined for the orbital debris. First, these equations were compared to each other, then each equation was compared with various aluminum projectile densities. Finally, these equations were compared with test results performed at JSC for the Marshall Space Flight Center. These equations pre-

dict a wide range of projectile diameters at a given velocity. Thus, it is very difficult to choose the "right" prediction equation. The thickness of the single plate could have a large variation by choosing a different penetration equation. Even though all five equations are empirically developed with various materials, and especially for aluminum alloys, one cannot be confident in the shield design with the predictions obtained by the penetration equations without verifying by tests.

TM-103566 April 1992  
 Space Science Laboratory Publications and Presentations January 1–December 31, 1991. Compiled by T.W. Moorehead. Space Science Laboratory. N92-25298

This document lists the significant publications and presentations of the Space Science Laboratory during the period January 1–December 31, 1991. Entries in the main part of the document are categorized according to NASA Reports (arranged by report number), Open Literature, and Presentations (arranged alphabetically by title). Also included for completeness is an appendix (arranged by report number) listing preprints issued by the Laboratory during this reporting period. Some of the preprints have not yet been published; those already published are so indicated. Most of the articles listed under Open Literature have appeared in refereed professional journals, books, or conference proceedings. Although many published abstracts are eventually expanded into full papers for publication in scientific and technical journals, they are often sufficiently comprehensive to include the significant results of the research reported. Therefore, published abstracts are listed separately in a subsection under Open Literature. Questions or requests for additional information about the entries in this report should be directed to Ms. T. Moorehead (ES01; 544-7581) or to one of the authors. The organizational code of the cognizant SSL branch or office is given at the end of each entry.

TM-103567 October 1991  
 FY 1991 Scientific and Technical Reports, Articles, Papers, and Presentations. Compiled by J.E. Turner. Management Operations Office. N92-17586

This document presents formal NASA technical reports, papers published in technical journals, and presentations by MSFC personnel in FY91. It also includes papers of MSFC contractors.

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After being announced in STAR, all of the NASA series reports may be obtained from the National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161.

The information in this report may be of value to the scientific and engineering community in determining what information has been published and what is available.

TM-103568

January 1992

Thermal Analysis Workbook. Edited by J.W. Owen. Structures and Dynamics Laboratory.

N92-70379

This workbook is intended to allow the user to gain a better understanding of thermal analysis, problem-solving techniques, and interpretation of results. Many simple and complex engineering problems are presented and solved. These are solved using state-of-the-art thermal analysis codes, closed form solutions (which are used as "sanity checks" for the codes), and many different numerical techniques with explanations of the methods and assumptions used in solving the problems. Physical phenomena which are considered include conduction, convection, radiation, change of phase, compressible and incompressible flow, N-dimensional branching networks, conjugate thermal/hydraulic analysis, Joule-Thompson heating, analysis of gas mixture concentrations, venting, ablation, and related subjects. Some codes discussed include SINDA, TRASYS, ANSYS, PATRAN, and other job specific codes.

TM-103569

November 1991

BUGS System Clock Distributor. T.M. Dietrich. Space Science Laboratory.

N92-20371

A printed circuit board which will provide external clocks and precisely measure the time at which events take place has been designed for the Bristol University Gas Spectrometer (BUGS). The board, which has been designed to interface both mechanically and electrically to the CAMAC system, has been named the BUGS system clock board. This document describes the board's design and how to use it.

TM-103570

January 1992

SUNSPOT—A Program to Model the Behavior of Hypervelocity Impact Damaged Multilayer Insulation in the Sunspot Thermal Vacuum Chamber of Marshall Space Flight Center. W.K.

Rule and K.B. Hayashida. Structures and Dynamics Laboratory. N92-18383

This report describes the development of a computer program to predict the degradation of the insulating capabilities of the multilayer insulation (MLI) blanket of Space Station *Freedom* due to a hypervelocity impact with a space debris particle. A finite difference scheme is used for the calculations. The computer program was written in Microsoft BASIC. This report also describes a test program that was undertaken to validate the numerical model. Twelve MLI specimens were impacted at hypervelocities with simulated debris particles using a light gas gun at Marshall Space Flight Center. The impact-damaged MLI specimens were then tested for insulating capability in the space environment of the Sunspot thermal vacuum chamber at MSFC. Two undamaged MLI specimens were also tested for comparison with the test results of the damaged specimens. The numerical model was found to adequately predict the behavior of the MLI specimens in the Sunspot chamber. A parameter, called diameter ratio, was developed to relate the nominal MLI impact damage to the apparent (for thermal analysis purposes) impact damage based on the hypervelocity impact conditions of a specimen.

TM-103571

January 1992

Optical Synthesizer for a Large Quadrant-Array CCD Camera—Center Director's Discretionary Fund Final Report (Project Number 90-11). M.J. Hagyard. Space Science Laboratory. N92-19001

This document constitutes the final report for MSFC Center Director's Discretionary Fund Project Number 90-11. The objective of this program was to design and develop an optical device, an optical synthesizer, that focuses four contiguous quadrants of a solar image on four spatially separated CCD arrays that are part of a unique CCD camera system. This camera and the optical synthesizer will be part of the new MSFC Experimental Vector Magnetograph, an instrument developed to measure the Sun's magnetic field as accurately as present technology allows. This report outlines the tasks undertaken in the program and presents the final detailed optical design.

TM-103572

January 1992

Space Transportation Architecture: Reliability Sensitivities. A.M. Williams. Preliminary Design Office. N92-19542

This report is a sensitivity analysis of the benefits and drawbacks associated with a proposed Earth-to-orbit vehicle architecture. The architecture represents a fleet of six vehicles (two existing, four proposed) that would be responsible for performing various missions as mandated by NASA and USAF. Each vehicle has a prescribed flight rate per year for a period of 31 years.

By exposing this fleet of vehicles to a probabilistic environment where the fleet experiences failures, downtimes, setbacks, etc., the analysis involves determining the resiliency and costs associated with the fleet of specific vehicle/subsystem reliabilities.

The resources required were actual observed data on the failures and downtimes associated with existing vehicles, data based on engineering judgment for proposed vehicles, and the development of a sensitivity analysis program.

TM-103573 February 1992  
A Real-Time Recursive Filter for the Attitude Determination of the Spacelab Instrument Pointing Subsystem. M.E. West. Structures and Dynamics Laboratory. N92-19920

A real-time estimation filter which reduces sensitivity to system variations and reduces the amount of preflight computation is developed for the instrument pointing subsystem (IPS). The IPS is a three-axis stabilized platform developed to point various astronomical observation instruments aboard the shuttle. Currently, the IPS utilizes a linearized Kalman filter (LKF), with premission defined gains, to compensate for system drifts and accumulated attitude errors. Since the a priori gains are generated for an expected system, variations result in a sub-optimal estimation process.

This report compares the performance of three real-time estimation filters with current LKF implementation. An extended Kalman filter and a second-order Kalman filter are developed to account for the system nonlinearities, while a linear Kalman filter implementation assumes that the nonlinearities are negligible. The performance of each of the four estimation filters are compared with respect to accuracy, stability, settling time, robustness, and computational requirements. It is shown that, for the current IPS pointing requirements, the linear Kalman filter provides improved robustness over the LKF with less computational requirements than the two real-time nonlinear estimation filters.

TM-103574 January 1992  
Atmospheric Environment for Space Shuttle *Atlantis* (STS-39) Launch. G.L. Jasper and G.W. Batts. Space Science Laboratory. N92-20411

This report presents a summary of selected atmospheric conditions observed near space shuttle *Atlantis* STS-39 launch time on April 28, 1991, at Kennedy Space Center, FL. Values of ambient pressure, temperature, moisture, ground winds, visual observations (cloud), and winds aloft are included. The sequence of prelaunch Jimsphere-measured vertical wind profiles is given in this report. The final atmospheric tape, which consists of wind and thermodynamic parameters versus altitude, for STS-39 vehicle ascent has been constructed. The STS-39 ascent atmospheric data tape has been constructed by Marshall Space Flight Center's Earth Science and Applications Division to provide an internally consistent data set for use in postflight performance assessments and represents the best estimate of the launch environment to the 400,000-ft altitude that was traversed by the STS-39 vehicle.

TM-103575 January 1992  
Space Transportation System and Associated Payloads: Glossary, Acronyms, and Abbreviations. Compiled by Management Operations Office and Space Shuttle Projects Office. N92-22108

This is a collection of some of the acronyms and abbreviations now in everyday use in the shuttle world. It is a combination of lists that have been prepared at Marshall Space Flight Center and Kennedy and Johnson Space Centers, places where intensive shuttle activities are being carried out. This list is intended as a guide or reference and should not be considered to have the status and sanction of a dictionary.

TM-103576 February 1992  
Space Station *Freedom* Delta Pressure Leakage Rate Comparison Test Data Analysis Report. E.B. Sorensen. Propulsion Laboratory. N92-22032

This report provides results of a series of tests performed to identify the relationship between gas leakage rates across a seal at various internal to external pressure ratios. This report is intended to complement the results and provide insight into the analysis technique used to obtain the results

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presented in MSFC SSF/DEV/EL91-008, "Space Station *Freedom* (S.S. *Freedom*) Seal Flaw Study With Delta Pressure Leak Rate Comparison Test Report."

TM-103577

March 1992

NASA Marshall Space Flight Center Solar Observatory Report—July–December 1991. J.E. Smith. Space Science Laboratory. N92-22387

This report provides a description of the NASA Marshall Space Flight Center's Solar Vector Magnetograph Facility and gives a summary of its observations and data reduction during July–December 1991. The systems that make up the facility are a magnetograph telescope, an H-alpha telescope, a Questar telescope, and a computer code.

TM-103578

April 1992

High-Altitude Solar-Powered Platform. M.D. Bailey and M.V. Bower. Structures and Dynamics Laboratory. N92-21546

Solar power is a preeminent alternative to conventional aircraft propulsion. Previously, relatively small solar-powered aircraft with limited usefulness have flown for short durations. With continued advances in solar cells, fuel cells, and composite materials technology, the solar-powered airplane is no longer a simple curiosity constrained to flights of several feet in altitude or minutes of duration.

A high-altitude solar-powered platform (HASPP) has several potential missions, including communications and agriculture. In remote areas, a HASPP could be used as a communications link. In large farming areas, a HASPP could perform remote sensing of crops.

The impact of a HASPP in continuous flight for 1 year on an agriculture monitoring mission is presented. This mission provides farmers with near real-time data twice daily from an altitude which allows excellent resolution on water conditions, crop diseases, and insect infestation. Accurate, timely data will enable farmers to increase their yield and efficiency.

A design for a HASPP for the foregoing mission is presented. In the design, power derived from solar cells covering the wings is used for propulsion, avionics, and sensors. Excess power produced mid-day will be stored in fuel cells for use at night to maintain altitude and course.

TM-103579

April 1992

Microbial Biofilm Studies of the Environmental Control and Life Support System Water Recovery Test for Space Station *Freedom*. D.C. Obenhuber, T.L. Huff, and E.B. Rodgers. Materials and Processes Laboratory. N92-22283

NASA is developing a water recovery system (WRS) for Space Station *Freedom* to reclaim human waste water for reuse by astronauts as hygiene or potable water. A water recovery test (WRT) currently in progress investigates the performance of a prototype of the WRS. Analysis of biofilm accumulation, the potential for microbially influenced corrosion (MIC) in the WRT, and studies of iodine disinfection of biofilm are reported.

Analysis of WRT components indicated the presence of organic deposits and biofilms in selected tubing. Water samples for the WRT contained acid-producing and sulfate-reducing organisms implicated in corrosion processes. Corrosion of an aluminum alloy was accelerated in the presence of these water samples; however, stainless steel corrosion rates were not accelerated.

Biofilm iodine sensitivity tests using an experimental laboratory-scale recycled water system containing a microbial check valve (MCV) demonstrated that an iodine concentration of 1 to 2 mg/L was ineffective in eliminating microbial biofilm. For complete disinfection, an initial concentration of 16 mg/L was required which was gradually reduced by the MCV over 4 to 8 hours to 1 to 2 mg/L. This treatment may be useful in controlling biofilm formation.

TM-103580

March 1992

Testing and Analyses of Electrochemical Cells Using Frequency Response—Center Director's Discretionary Fund Final Report, Project No. 90-18. O.A. Norton, Jr. and D.L. Thomas. Information and Electronic Systems Laboratory. N92-23437

The feasibility of electrochemical impedance spectroscopy as a method for analyzing battery state of health and state of charge was investigated. Porous silver, zinc, nickel, and cadmium electrodes as well as silver/zinc cells were studied. State of charge could be correlated with impedance data for all but the nickel electrodes. State of health was correlated with impedance data for two silver/zinc cells, one apparently good and the other dead. The experimental data were fit to equivalent circuit models.

## NASA TECHNICAL MEMORANDUM

TM-103581  
Coupled Loads Analysis for Space Shuttle  
Payloads. J. Eldridge. Structures and Dynamics  
Laboratory.  
May 1992  
N92-24708

This report describes a method for determining the transient response of, and the resultant loads in, a system exposed to predicted external forces. In this case, the system consists of four racks mounted on the inside of a space station resource node module (SSRNMO) which is mounted in the payload bay of the space shuttle. The predicted external forces are forcing functions which envelop worst case forces applied to the shuttle during lift-off and landing. This analysis, called a coupled loads analysis, is used to; (a) couple the payload and shuttle models together, (b) determine the transient response of the system; and then (c) recover payload loads, payload accelerations, and payload to shuttle interface forces.

TM-103582 April 1992  
Performance of Thermal Control Tape in the  
Protection of Composite Materials to Space  
Environmental Exposure. R.R. Kamenetzky and  
A.F. Whitaker. Materials and Processes  
Laboratory. N92-24982

Thermal control tape flown on the long duration exposure facility (LDEF) experiment AO171 has shown to be effective in protecting epoxy fiberglass composites from atomic oxygen and ultraviolet (UV) degradation. The tape adhesive performed well. The aluminum, however, appeared to have become embrittled by the 5.8 years of space exposure.

TM-103583  
June 1992  
Report for Neutral Buoyancy Simulations of  
Transfer Orbit Stage Contingency  
Extravehicular Activities. J.D. Sexton. Mission  
Operations Laboratory. N92-26268

The transfer orbit stage (TOS) will propel the advanced communications technology satellite (ACTS) from the space shuttle to an Earth geosynchronous transfer orbit. Two neutral buoyancy test series were conducted at MSFC to validate the extravehicular activities (EVA) contingency operations for the ACTS/TOS mission. This report delineates the results of the neutral buoyancy tests and gives a brief history of the TOS EVA program. Test numbers are: NBS-TOS-90.1 and NBS-TOS-91.1.

TM-103584  
June 1992  
Microbiology Report for Phase III Stage A  
Water Recovery Test. M.C. Roman and S.A.  
Minton. Structures and Dynamics Laboratory.  
X92-10382

The Environmental Control and Life Support System (ECLSS) test program at NASA/Marshall Space Flight Center (MSFC) developed a physical/chemical treatment system to reclaim wastewater for reuse aboard Space Station *Freedom* (S.S. *Freedom*). This report provides microbiological data gathered during phase III testing of the water recovery test (WRT) which was conducted from May through July, 1990. Phase III testing was conducted in the Core Module Integration Facility (CMIF) located in building 4755 at MSFC. The CMIF included a core module simulator (CMS) containing separate potable and hygiene water reclamation hardware integrated with the End-Use Equipment Facility (EEF) which included exercise equipment, shower, handwasher, clotheswasher, and dishwasher. With the participation of human test subjects, wastewater and metabolic condensate were produced.

TM-103585 June 1992  
Atmospheric Environment for Space Shuttle  
*Columbia* (STS-40) Launch. G.L. Jasper and  
G.W. Batts. Space Science Laboratory.  
N92-26288

This report presents a summary of selected atmospheric conditions observed near Space Shuttle *Columbia* (STS-40) launch time on June 5, 1991, at Kennedy Space Center, Florida. Values of ambient pressure, temperature, moisture, ground winds, visual observations (cloud), and winds aloft are included. The sequence of prelaunch Jimsphere-measured vertical wind profiles is given in this report. The final atmospheric tape, which consists of wind and thermodynamic parameters versus altitude, for STS-40 vehicle ascent has been constructed. The STS-40 ascent atmospheric data tape has been constructed by Marshall Space Flight Center's Earth Science and Applications Division to provide an internally consistent data set for use in postflight performance assessments and represents the best estimate of the launch environment to the 400,000-ft altitude that was traversed by the STS-40 vehicle.

# NASA TECHNICAL MEMORANDUM

TM-103586

May 1992

Taguchi Methods in Electronics—A Case Study.  
R. Kissel. Information and Electronic Systems  
Laboratory. N92-28456

A pilot project in Taguchi methods was completed using actual electronic hardware. The primary purpose was to familiarize engineers and managers with the theory and mechanics of doing a Taguchi experiment. The hardware selected was the National Launch System (NLS) electromechanical actuator (EMA) control electronics. This is a 25-kW motor controller. Actual preparation and test time was 3 to 4 weeks. Results were quite good since the predicted optimum set of component values also had the highest measured signal-to-noise ratio (S/N).

TM-103587

June 1992

Assessment of a Head-Mounted Miniature Monitor—Center Director's Discretionary Fund Final Report (Project Number 89-07). J.P. Hale II. Mission Operations Laboratory. N92-30381

Two experiments were conducted to assess the capabilities and limitations of the Private Eye, a miniature, head-mounted monitor. The first experiment compared the Private Eye with a CRT and hard copy in both a constrained and unconstrained work envelope. The task was a simulated maintenance and assembly task that required frequent reference to the displayed information. A main effect of presentation media indicated faster placement times using the CRT as compared with hard copy. There were no significant differences between the Private Eye and either the CRT or hard copy for identification, placement, or total task times. The goal of the second experiment was to determine the effects of various local visual parameters on the ability of the user to accurately perceive the information of the Private Eye. The task was an interactive video game. No significant performance differences were found under either bright or dark ambient illumination environments nor with either visually simple or complex task backgrounds. Glare reflected off of the bezel surrounding the monitor did degrade performance. It was concluded that this head-mounted, miniature monitor could serve a useful role for in situ operations, especially in microgravity environments.

TM-103588

June 1992

Anthropomorphic Teleoperation: Controlling Remote Manipulators With the DataGlove—Center Director's Discretionary Fund Final

Report (Project Number 89-06). J.P. Hale II. Mission Operations Laboratory. N92-28521

A two-phase effort was conducted to assess the capabilities and limitations of the DataGlove, a lightweight glove input device that can output signals in real-time based on hand shape, orientation, and movement. The first phase was a period for system integration, checkout, and familiarization in a virtual environment. The second phase was a formal experiment using the DataGlove as an input device to control the protoflight manipulator arm (PFMA)—a large telerobotic arm with an 8-ft reach. The first phase was used to explore and understand how the DataGlove functions in a virtual environment, build a virtual PFMA, and consider and select a reasonable teleoperation control methodology. Twelve volunteers (six males and six females) participated in a  $2 \times 3 \times 2$  full-factorial formal experiment using the DataGlove to control the PFMA in a simple retraction, slewing, and insertion task. Two within-subjects variables, time delay (0, 1, and 2 seconds) and PFMA wrist flexibility (rigid/flexible), were manipulated. Gender served as a blocking variable. A main effect of time delay was found for slewing and total task times. Correlations among questionnaire responses, and between questionnaire responses and session mean scores and gender, were computed. The experimental data were also compared with data collected in another study that used a six degree-of-freedom hand controller to control the PFMA in the same task. It was concluded that the DataGlove is a legitimate teleoperations input device that provides a natural, intuitive user interface. From an operational point of view, it compares favorably with other "standard" telerobotic input devices and should be considered in future trades in teleoperation systems' designs.

TM-103589

May 1992

The Effect of Induced Charges on Low-Energy Particle Trajectories Near Conducting and Semiconducting Plates. V.N. Coffey. Space Science Laboratory. N92-28986

The effect of the induced charge was found on particles less than 1 eV as they passed through simulated parallel, grounded channels that are comparable in dimension to those that are presently in space plasma instruments which measure the flux of low-energy ions. Applications were made to both conducting and semiconducting channels that ranged in length from 0.1 to 50 mm and in aspect ratio from 1 to 100. The effect of the induced charge on particle

trajectories is illustrated, and results are given for the reduction of the channel geometric factor as a function of particle energy due to the deviation of trajectories from simple straight lines. Several configurations of channel aspect ratio and detector locations are considered. The effect is important only at very low energies with small dimensions.

TM-103590

July 1992

A Generalized Reusable Guidance Algorithm for Optimal Aerobraking. G.A. Dukeman. Systems Analysis and Integration Laboratory. N92-28981

A practical real-time guidance algorithm has been developed for guiding aerobraking vehicles in such a way that the maximum heating rate, the maximum structural loads, and the post-aeropass delta-V requirement (for post-aeropass orbit insertion) are all minimized. The algorithm is general and reusable in the sense that a minimum of assumptions are made, thus minimizing the number of gains and mission-dependent parameters that must be laboriously determined prior to a particular mission. A particularly interesting feature is that inplane guidance performance is tuned by simply adjusting one mission-dependent parameter, the bank margin; similarly, the out-of-plane guidance performance is tuned by simply adjusting a plane controller time constant. Other objectives in the algorithm development are simplicity, efficiency, and ease of use. The algorithm is developed for, but not necessarily restricted to, a single pass mission and a trimmed vehicle with bank angle modulation as the method of trajectory control. Guidance performance is demonstrated via results obtained using this algorithm integrated into an aerobraking test-bed program. Comparisons are made with numerical results from a version of the aerobraking guidance algorithm that was to be flown onboard NASA's aeroassist flight experiment (AFE) vehicle. Promising results are obtained with a minimum of development effort.

TM-103591

July 1992

Linear Elastic Fracture Mechanics Primer. C.D. Wilson. Structures and Dynamics Laboratory. N92-30416

This primer is intended to remove the "blackbox" perception of fracture mechanics computer software by structural engineers. The fundamental concepts of linear elastic fracture mechanics are presented with emphasis on the practical application of fracture mechanics to real problems. Numerous "rules of thumb" are provided.

Recommended texts for additional reading, and a discussion of the significance of fracture mechanics in structural design, are given. Griffith's criterion for crack extension, Irwin's elastic stress field near the crack tip, and the influence of small-scale plasticity are discussed. Common stress intensity factor solutions and methods for determining them are included. Fracture toughness and subcritical crack growth are discussed. The application of fracture mechanics to damage tolerance and fracture control is discussed. Several example problems and a practice set of problems are given.

TM-103592

July 1992

Comparison of Epifluorescent Viable Bacterial Count Methods. E.B. Rodgers and T.L. Huff. Materials and Processes Laboratory. N92-30305

Two methods, the 2-(4-Iodophenyl)-3-(4-nitrophenyl)-5-phenyltetrazolium chloride (INT) method and the direct viable count method (DVC), were tested and compared for their efficacy for the determination of the viability of bacterial populations. Use of the INT method results in the formation of a dark spot within each respiring cell. The DVC method results in elongation or swelling of growing cells that are rendered incapable of cell division. Although both methods are subjective and can result in false positive results, the DVC method is best suited to analysis of waters in which the number of different types of organisms present in the sample is assumed to be small, such as processed waters. The advantages and disadvantages of each method are discussed.

TM-103593

July 1992

Analysis of Debris From Spacelab Space Life Sciences-1. S.V. Caruso, E.B. Rodgers, and T.L. Huff. Materials and Processes Laboratory. N92-32148

Airborne microbiological and particulate contamination generated aboard Spacelab modules is a potential safety hazard. In order to shed light on the characteristics of these contaminants, microbial and chemical/particulate analyses were performed on debris vacuumed from cabin and avionics air filters in the Space Life Sciences-1 (SLS-1) module of the Space Transportation System 40 (STS-40) mission 1 month after landing. The debris was sorted into categories (e.g., metal, nonmetal, hair/fur, synthetic fibers, food particles, insect fragments, etc.). Elemental analysis of particles was done by energy dispersive analysis of x rays (metals) and Fourier

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transform infrared spectroscopy (nonmetals). Scanning electron micrographs were done of most particles. Microbiological samples were grown on R2A culture medium and identified. Clothing fibers dominated the debris by volume. Other particles, all attributed to the crew, resulted from abrasions and impacts during mission operations (e.g., paint chips, plastic, electronic scraps, clothing fibers). All bacterial species identified are commonly found in the atmosphere or on the human body. *Bacillus* sp. was the most frequently seen bacterium. One of the bacterial species, *Enterobacter agglomerans*, could cause illness in crew members with depressed immune systems.

TM-103594 July 1992  
A Reduced Gravity Fiber Pulling Apparatus.  
D.S. Tucker. Materials and Processes  
Laboratory. N92-30971

A reduced gravity fiber pulling apparatus (FPA) has been constructed in order to study the effects of gravity on glass fiber formation. The apparatus was specifically designed and built for use on NASA's KC-135 aircraft. Four flights have been completed to date during which E-glass fiber was successfully produced in simulated lunar gravity.

TM-103595 August 1992  
A Study of Enhancing Critical Current Densities ( $J_c$ ) and Critical Temperature ( $T_c$ ) of High-Temperature Superconductors—Center Director's Discretionary Fund Final Report (Project 90-N26). M. Vlasse, Space Science Laboratory. N92-30902

The development of pure phase 123 and Bi-based 2223 superconductors has been optimized. The preheat processing appears to be a very important parameter in achieving optimal physical properties. The synthesis of pure phases in the Bi-based system involves effects due to oxygen partial pressure, time, and temperature. Orientation/melt-sintering effects include the extreme c-axis orientation of Yttrium 123 and the Bismuth 2223, 2212, and 2201 phases. This orientation is conducive to increasing critical currents. A procedure was established to substitute Sr for Ba in Y-123 single crystals.

TM-103596 July 1992  
Wear Mechanisms Found in Angular Contact Ball Bearings of the SSME's Lox Turbopumps.  
T.J. Chase. Propulsion Laboratory.

Extensive experimental investigation has been carried out on used flight bearings of the phase II high-pressure oxygen turbopump (HPOTP) of the space shuttle main engine (SSME) in order to determine the wear mechanisms, dominant wear modes, and their extent and causes. The report shows methodology, surface analysis techniques used, results, and discussion. The mode largely responsible for heavy bearing wear in lox has been identified as adhesive/shear peeling of the upper layers of bearing balls and rings. The mode relies on the mechanisms of scale formation, breakdown, and removal, all of which are greatly enhanced by the heavy oxidation environment of the HPOTP. Major causes of the high wear in bearings appear to be lubrication and cooling, both inadequate for the imposed conditions of operation. Numerous illustrations and evidence are given.

TM-103597 August 1992  
NASA Marshall Space Flight Center Solar Observatory Report—January–June 1992. J.E. Smith. Space Science Laboratory. N92-32478

This report provides a description of the NASA Marshall Space Flight Center's Solar Vector Magnetograph Facility and gives a summary of its observations and data reduction during January–June 1992. The systems that make up the facility are a magnetograph telescope, an H-alpha telescope, a Questar telescope, and a computer code.

TM-103598 August 1992  
Development of Static System Procedures to Study Aquatic Biofilms and Their Responses to Disinfection and Invading Species. G.A. Smithers. Materials and Processes Laboratory.

The microbial ecology facility in the Analytical and Physical Chemistry Branch at Marshall Space Flight Center is tasked with anticipation of potential microbial problems (and opportunities to exploit microorganisms) which may occur in partially closed systems such as space stations/vehicles/habitats and in water reclamation systems therein, with particular emphasis on the degradation of materials. Within this context, procedures for microbial biofilm research are being developed. Reported here is the development of static system procedures to study aquatic biofilms and their responses to disinfection and invading species. Preliminary investigations have been completed. As procedures are refined, it will be possible to focus



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more closely on the elucidation of biofilm phenomena.

TM-103600 August 1992  
Fabrication of High  $T_c$  Superconductor Thin Film Devices—Center Director's Discretionary Fund Final Report (Project No. P17). R.C. Sisk. Space Science Laboratory.

This report describes a technique for fabricating superconducting weak link devices with micron-sized geometries etched in laser ablated  $Y_1Ba_2Cu_3O_x$  (YBCO) thin films. Careful placement of the weak link over naturally occurring grain boundaries exhibited in some YBCO thin films produces Superconducting Quantum Interference Devices (SQUID's) operating at 77 K.

TM-103601 August 1992  
A Comparison of High Cycle Fatigue Methodologies. D.A. Herda. Structures and Dynamics Laboratory.

To evaluate alternate turbopump development (ATD) high cycle fatigue (HCF) methodology, a comparison was made with the space shuttle main engine (SSME) methodology. This report documents the comparison and evaluates ATD's HCF system.

TM-103602 September 1992  
The Effect of Weld Porosity on the Cryogenic Fatigue Strength of ELI Grade Ti-5Al-2.5Sn. P.R. Rogers, R.C. Lambdin, and D.E. Fox. Materials and Processes Laboratory.

The effect of weld porosity on the fatigue strength of ELI grade Ti-5Al-2.5Sn at cryogenic temperature was determined. A series of high cycle fatigue (HCF) and tensile tests were performed at  $-320^\circ\text{F}$  on specimens made from welded sheets of the material. All specimens were tested with weld beads intact and some amount of weld offset. Specimens containing porosity and control specimens containing no porosity were tested. Results indicate that for the weld configuration tested, the fatigue life of the material is not affected by the presence of spherical embedded pores.

TM-103603 September 1992  
Atmospheric Environment for Space Shuttle *Atlantis* (STS-43) Launch. G.L. Jasper and G.W. Batts. Space Science Laboratory.

This report presents a summary of selected atmospheric conditions observed near Space Shuttle *Atlantis* (STS-43) launch time on August 2, 1991, at Kennedy Space Center, FL. Values of ambient pressure, temperature, moisture, ground winds, visual observations (cloud), and winds aloft are included. The sequence of prelaunch Jimsphere-measured vertical wind profiles is given in this report. The final atmospheric profile, which consists of wind and thermodynamic parameters versus altitude, for STS-43 vehicle ascent has been constructed. The STS-43 ascent atmospheric data profile has been constructed by Marshall Space Flight Center's Earth Science and Applications Division to provide an internally consistent data set for use in postflight performance assessments and represents the best estimate of the launch environment to the 400,000-ft altitude that was traversed by the STS-43 vehicle.

TM-103604 August 1992  
Space Station *Freedom* Seal Leakage Rate Analysis and Testing Summary: Air Leaks in Ambient Pressure Versus Vacuum Exit Conditions. P.I. Rodriguez and R. Markovitch. Structures and Dynamics Laboratory.

This report is intended to reveal the apparent relationship of air seal leakage rates between 2 atmospheres (atm) to 1 atm and 1 atm to vacuum conditions. Gas dynamic analysis is provided as well as data summarizing MSFC test report, "Space Station *Freedom* (S.S. *Freedom*) Seal Flaw Study With Delta Pressure Leak Rate Comparison Test Report," SSF/DEV/ED91-008.

TM-108373 April 1992  
Hubble Space Telescope Thermal Cycle Test Report for Large Solar Array Samples With BSFR Cells (Sample Numbers 703 and 704). D.W. Alexander. Information and Electronic Systems Laboratory.

The Hubble space telescope (HST) solar array was designed to meet specific output power requirements after 2 years in low-Earth orbit, and to remain operational for 5 years. The array, therefore, had to withstand 30,000 thermal cycles between approximately  $+100$  and  $-100^\circ\text{C}$ . The ability of the array to meet this requirement was evaluated by thermal cycle testing, in vacuum, two 128-cell solar cell modules that exactly duplicated the flight HST solar array design. Also, the ability of the flight array to survive an emergency deployment during

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the dark (cold) portion of an orbit was evaluated by performing a cold-roll test using one module.

TM-108374 September 1992  
An Impact Investigation of the TOS-2 Case Damage. A.T. Nettles and D.G. Lance. Materials and Processes Laboratory.

An impact investigation was performed on segments of a transfer-to-orbit stage (TOS) Kevlar/epoxy pressure vessel to assist in the evaluation of the damage sustained by a TOS-2 motor case during a handling accident. The impact conditions were replicated using an instrumented drop weight tower with a modified impactor. No. 10 bolts were used as impact tups to better simulate the accident. The similarities of the surface damage between the specimens and the actual case were observed before the specimens were cross-sectionally cut and examined. The results showed that, while no significant subsurface damage was observed in the test specimens, the damage was subtle and could not be predicted by visual examination of the external surface or by available NDE methods.

TM-4340 February 1992  
Space Station *Freedom* Environmental Control and Life Support System Regenerative Subsystem Selection. R.L. Carrasquillo, D.L. Carter, D.W. Holder, Jr., C.F. McGriff, and K.Y. Ogle. Materials and Processes Laboratory.  
X92-10278

In support of Space Station *Freedom* phase C/D environmental control and life support systems (ECLSS) regenerative systems development, comparative testing was performed on predevelopment hardware of competing technologies for each regenerative function. This testing was conducted by the Boeing Aerospace and Electronics Company (BAE) at Marshall Space Flight Center (MSFC) from late 1989 through early 1990. The purpose of the test program was to collect data on latest generation hardware in order to make final technology selections for each subassembly in the oxygen recovery and water reclamation strings. This report discusses the testing performed, test results, and evaluation of these results relative to subsystem selections for CO<sub>2</sub> reduction, O<sub>2</sub> generation, potable water processing, hygiene water processing, and urine processing.

TM-4350 February 1992  
Lightning Imaging Sensor (LIS) for the Earth Observing System. H.J. Christian, R.J. Blakeslee, and S.J. Goodman. Space Science Laboratory.  
N92-20036

This document describes scientific objectives and instrument characteristics of a calibrated optical lightning imaging sensor (LIS) for the Earth observing system (EOS) and the tropical rainfall measuring mission (TRMM) designed to acquire and investigate the distribution and variability of total lightning on a global basis. The LIS is an EOS instrument, whose lineage can be traced to a lightning mapper sensor planned for flight on the GOES series of operational meteorological satellites. The LIS is conceptually a simple device, consisting of a staring imager optimized to detect and locate lightning. The LIS will detect and locate lightning with storm scale resolution (i.e., 5 to 10 km) over a large region of the Earth's surface along the orbital track of the satellite, mark the time of occurrence of the lightning, and measure the radiant energy. The LIS will have a nearly uniform 90-percent detection efficiency within the area viewed by the sensor, and will detect intracloud and cloud-to-ground discharges during day and night conditions. In addition, the LIS will monitor individual storms and storm systems long enough (i.e., 2 min) to obtain a measure of the lightning flashing rate in these storms when they are within the field of view of the LIS. The LIS attributes include low cost, low weight and power (15 kg, 30 W), low data rate (6 kb/s), and important science. The LIS will contribute to studies of the hydrological cycle, general circulation and sea-surface temperature variations, investigations of the electrical coupling of thunderstorms with the ionosphere and magnetosphere, and observations and modeling of the global electric circuit. It will provide a global lightning climatology from which changes, caused perhaps by subtle temperature variations, will be readily detected.

TM-4353 February 1992  
First International Microgravity Laboratory Experiment Descriptions—First Edition. T.Y. Miller, Editor. Space Science Laboratory.  
N92-23600

This document contains brief descriptions of the experiments for the first international microgravity laboratory (IML-1) which is scheduled for launch from the Kennedy Space Center aboard the orbiter *Discovery* in early 1992.

TM-4388

June 1992

Functional Requirements Document for NASA/MSFC Earth Science and Applications Division—Data and Information System (ESAD-DIS) Interoperability, 1992. J.B. Stephens, and G.W. Grider. Space Science Laboratory. N92-26905

These ESAD-DIS interoperability requirements are designed to quantify the Earth Science and Applications Division's hardware and software requirements in terms of communications between personal and visualization workstation and main-frame computers. The electronic mail requirements and LAN requirements are addressed. These interoperability requirements are top-level requirements framed around defining the existing ESAD-DIS interoperability and projecting known near-term requirements for both operational support and for management planning. Detailed requirements will be submitted on a case-by-case basis. This document is also intended as an overview of ESAD-DIS interoperability for newcomers and management not familiar with these activities. It is intended as background documentation to support requests for resources and support requirements.

TM-4392

June 1992

Functional Requirements Document for the Earth Observing System Data and Information System (EOS DIS) Scientific Computing Facilities (SCF) of the NASA/MSFC Earth Science and Applications Division, 1992. M.E. Botts, R.J. Phillips, J.V. Parker, and P.D. Wright. Space Science Laboratory. N92-28899

Five scientists at MSFC/ESAD have EOS SCF investigator status. Each SCF has unique tasks which require the establishment of a computing facility dedicated to accomplishing those tasks. An SCF Working Group was established at ESAD with the charter of defining the computing requirements of the individual SCF's and recommending options for meeting these requirements. The primary goal of the working group was to determine which computing needs can be satisfied using either shared resources or separate but compatible resources, and which needs require unique individual resources. The requirements investigated included CPU-intensive vector and scalar processing, visualization, data storage, connectivity, and I/O peripherals. A review of computer industry directions and a market survey of computing hardware provided information regarding important industry standards and candidate computing platforms. It was determined that the total SCF computing requirements might be most effectively met using a hierarchy consisting of shared and individual resources. This hierarchy is composed of five major system types: (1) a supercomputer class vector processor, (2) a high-end scalar multi-processor workstation, (3) a file server, (4) a few medium- to high-end visualization workstations, and (5) several low- to medium-range personal graphics workstations. Specific recommendations for meeting the needs of each of these types are presented.

TP-3160

October 1991

An Examination of the Damage Tolerance Enhancement of Carbon/Epoxy Using an Outer Lamina of Spectra®. D.G. Lance and A.T. Nettles. Materials and Processes Laboratory.

N92-11142

Low-velocity instrumented impact testing was utilized to examine the effects of an outer lamina of ultra-high molecular-weight polyethylene (Spectra) on the damage tolerance of carbon/epoxy composites. Four types of 16-ply quasi-isotropic panels, (0, +45, 90, -45)<sub>s2</sub> were tested. Some panels contained no Spectra, while others had a lamina of Spectra bonded to the top (impacted side), bottom, or both surfaces of the composite plates. The specimens were impacted with energies up to 8.5 J. Force-time plots and maximum force versus impact energy graphs were generated for comparison purposes. Specimens were also subjected to cross-sectional analysis and compression-after-impact tests. The results show that while the Spectra improved the maximum load that the panels could withstand before fiber breakage, the Spectra seemingly reduced the residual strength of the composites.

TP-3161

October 1991

Automating a Spacecraft Electrical Power System Using Expert Systems. L.F. Lollar. Information and Electronic Systems Laboratory.

N92-12052

Since Skylab, Marshall Space Flight Center (MSFC) has recognized the need for large electrical power systems (EPS's) in upcoming spacecraft. The operation of the spacecraft depends on the EPS. Therefore, it must be efficient, safe, and reliable. In 1978, as a consequence of having to supply a large number of EPS personnel to monitor and control Skylab, the Electrical Power Branch of MSFC began the autonomously managed power system (AMPS) project. This project resulted in the assembly of a 25-kW high-voltage dc test facility and provided the means of getting man out of the loop as much as possible. AMPS includes several embedded controllers which allow a significant level of autonomous operation. More recently, the Electrical Division at MSFC has developed the space station module power management and distribution (SSM/PMAD) breadboard to investigate managing and distributing power in the Space Station *Freedom* habitation and laboratory modules. Again, the requirement for a high level of autonomy for effi-

cient operation over the lifetime of the station and for the benefits of enhanced safety has been demonstrated. This paper describes the two breadboards and the hierarchical approach to automation which was developed through these projects.

TP-3163

October 1991

A Generalized Method for Multiple Robotic Manipulator Programming Applied to Vertical-Up Welding. K.R. Fernandez, G.E. Cook, K. Andersen, R.J. Barnett, and S. Zein-Sabattou. Information and Electronic Systems Laboratory.

N92-11218

This paper describes the application of a weld programming algorithm for vertical-up welding, which is frequently desired for variable polarity plasma arc welding (VPPAW). The Basic algorithm performs three tasks simultaneously: control of the robotic mechanism so that proper torch motion is achieved while minimizing the sum-of-squares of joint displacement; control of the torch while the part is maintained in a desired orientation; and control of the wire feed mechanism location with respect to the moving welding torch. This algorithm has been presented and demonstrated in earlier reports as applied to downhand welding, such as is required for gas tungsten arc welding (GTAW).

This paper also presents a modification of this algorithm which permits it to be used for vertical-up welding. The details of this modification are discussed and simulation examples are provided for illustration and verification.

TP-3177

December 1991

Optical Measurements on Solid Specimens of Solid Rocket Motor Exhaust and Solid Rocket Motor Slag. F.E. Roberts, III. Materials and Processes Laboratory.

N92-20949

Samples of alumina slag were investigated to aid the Earth Science and Applications Division at Marshall Space Flight Center (MSFC). Alumina from space motor propellant exhaust and space motor propellant slag was examined as a component of space refuse. Thermal emittance and solar absorptivity measurements were taken to support their comparison with reflectance measurements derived from actual debris. To determine the similarity between the samples, and space motor exhaust or space motor slag, emittance and absorbance results were correlated with an examination of specimen morphology.

- TP-3178 December 1991  
A Nonlinear Estimator for Reconstructing the Angular Velocity of a Spacecraft Without Rate Gyros. M.E. Polites and W.D. Lightsey. Structures and Dynamics Laboratory. N92-13343

This paper presents a new scheme for estimating the angular velocity of a spacecraft without rate gyros. It is based upon a nonlinear estimator whose inputs are measured inertial vectors and their calculated time-derivatives relative to vehicle axes. It works for all spacecraft attitudes and requires no knowledge of attitude. It can use measurements from a variety of onboard sensors like Sun sensors, star trackers, or magnetometers, and in concert. It can also use look angle measurements from onboard tracking antennas for tracking and data relay satellites or global positioning system satellites. In this paper, it is applied to a Sun point scheme on the Hubble space telescope assuming all or most of its onboard rate gyros have failed. Simulation results are presented which verify it.

- TP-3179 December 1991  
A Statistical Comparison of Two Carbon Fiber/Epoxy Fabrication Techniques. A.J. Hodge. Materials and Processes Laboratory. N92-20950

A statistical comparison of the compression strengths of specimens that were fabricated by either a platen press or an autoclave were performed on IM6/3501-6 carbon/epoxy composites of 16-ply (0,+45,90,-45)<sub>S2</sub> lay-up configuration. The samples were cured with the same parameters and processing materials. It was found that the autoclaved panels were thicker than the platen press-cured samples. Two hundred samples of each type of cure process were compression tested. The autoclaved samples had an average strength of 450 MPa (65.5 ksi), while the press-cured samples had an average strength of 370 MPa (54.0 ksi). A Weibull analysis of the data showed that there is only a 30-percent probability that the two types of cure systems yield specimens that can be considered from the same family.

- TP-3181 December 1991  
Limit Cycle Vibrations in Turbomachinery. S.G. Ryan. Structures and Dynamics Laboratory. N92-14108

High-performance turbomachinery is susceptible to a wide variety of vibration problems. Some of

these problems are rotor unbalance vibration, dynamic instability, and subharmonic response to unbalance excitation. Understanding these problems is complicated when nonlinearities are present, as they almost always are in actual hardware. For example, dynamic instabilities may manifest themselves as limit cycle vibrations. In some cases, the vibration levels are so high that the distinction between a divergent instability and a limit cycle is meaningless. This is because the machinery would be destroyed in either case. In other cases, the limit cycle may appear at relatively small levels. These cases may appear to be benign; however, the presence of the limit cycle may be an indication of an impending divergent instability. This matter is complicated by the fact that the frequency of the limit cycle instability is frequently near one-half of the unbalance excitation synchronous frequency. This makes it difficult to distinguish between the limit cycle and a subharmonic response.

The focus of this work is an examination of rotordynamic systems which are simultaneously susceptible to limit cycle instability and subharmonic response. Characteristics of each phenomenon are determined as well as their interrelationship. A normalized, single mass rotor model is examined as well as a complex model of the high-pressure fuel turbopump (HPFTP) of the space shuttle main engine (SSME). Entrainment of limit cycle instability by subharmonic response is demonstrated for both models. The nonuniqueness of the solution is also demonstrated.

- TP-3203 February 1992  
Structural Deterministic Safety Factors Selection Criteria and Verification. V. Verderaiame. Structures and Dynamics Laboratory. N92-19355

Though current deterministic safety factors are arbitrarily and unaccountably specified, its ratio is rooted in resistive and applied stress probability distributions. This study approached the deterministic method from a probabilistic concept leading to a more systematic and coherent philosophy and criterion for designing more uniform and reliable high-performance structures. The deterministic method was noted to consist of three safety factors—a standard deviation multiplier of the applied stress distribution, a K-factor for the A- or B-basis material ultimate stress, and the conventional safety factor to ensure that the applied stress does not operate in the inelastic zone of metallic materials. The conventional safety factor is specifically defined as the ratio

of ultimate to yield stresses. A deterministic safety index of the combined safety factors was derived from which the corresponding reliability proved the deterministic method is not reliability sensitive. Bases for selecting safety factors are presented, and verification requirements are discussed. The suggested deterministic approach is applicable to all NASA, DOD, and commercial high-performance structures under static stresses.

TP-3213 March 1992  
The Role of Failure/Problems in Engineering: A Commentary on Failures Experienced—Lessons Learned. R.S. Ryan. Structures and Dynamics Laboratory. N92-22235

This report presents the written version of a series of seminars given to several aerospace companies and three National Aeronautics and Space Administration (NASA) Centers. The results are lessons learned through a study of the problems experienced in 35 years of engineering. The basic conclusion is that the primary cause of problems has not been missing technologies, as important as technology is, but the neglect of basic principles. Undergirding this is the lack of a systems focus from determining requirements through design, verification, and operations phases. Many of the concepts discussed are fundamental to total quality management (TQM) and can be used to augment this product enhancement philosophy. Fourteen principles are addressed in this report with problems experienced used as examples. Included is a discussion of the implication of constraints, poorly defined requirements, and schedules. Design guidelines, lessons learned, and future tasks are listed. Two additional sections are included that deal with personal lessons learned and thoughts on future thrusts (TQM). A separate report, to be published later, will contain synopses of the problems experienced. They will be documented by project and cause. Approximately 175 problems have been treated to date.

TP-3215 March 1992  
Time-Frequency Representation of a Highly Nonstationary Signal Via the Modified Wigner Distribution. T.F. Zoladz, J.H. Jones, and J. Jong. Structures and Dynamics Laboratory. N92-20492

This report presents a new signal analysis technique called the modified Wigner distribution (MWD). The MWD has been developed for the

Structures and Dynamics Laboratory at MSFC by Dr. Jen-Yi Jong of Wyle Laboratories. The new signal processing tool has proven very successful in determining time-frequency representations of highly nonstationary multicomponent signals in both simulation and trials involving actual space shuttle main engine high-frequency data. The MWD departs from the classic Wigner distribution (WD) in that it effectively eliminates the cross coupling among positive frequency components in a multiple component signal. This attribute of the MWD, which prevents the generation of "phantom" spectral peaks, will undoubtedly increase the utility of the WD for real-world signal analysis applications which more often than not involve multicomponent signals.

TP-3218 April 1992  
The Effect of Acceleration Versus Displacement Methods on Steady-State Boundary Forces. D.S. McGhee. Structures and Dynamics Laboratory. N92-21457

When a substructure model is reduced by the Craig-Bampton method, a number of degrees-of-freedom (DOF's) are retained as physical DOF's to provide interface to other substructures. When more DOF's are retained in this interface than are actually required, the model is said to be over constrained. The result of this, when using the displacement method, is typically an inaccurate distribution of boundary forces. This inaccuracy also occurs when there are justifiably many interface DOF's which result in an indeterminate interface. When the acceleration method is used, this inaccuracy is overcome. However, many people do not fully understand this method and the many ways of implementing it, and so its implementation is sometimes haphazard.

This study describes the acceleration and displacement methods for use in the recovery of coupled system boundary forces. A simple 2-DOF system has been used for illustration. The effect of the choice of method for use with indeterminate or over-constrained boundaries has been investigated. It has specifically looked at results from a simple two-dimensional beam problem using both methods.

In the space shuttle payload community, there has been an increase in the use of over-constrained payload models. This has been, mainly, to afford easy recovery of relative deflection data between the payload and the shuttle. While there has also been an increase in the use of the acceleration method for the recovery of payload displacements and forces, the displacement method remains the method used for recovering system displacements and forces. Much

work has been done on the effects of Craig-Bampton modal truncation on system displacements and forces; however, little work has been done on system modal truncation (i.e., modes across the boundary). The findings of this study indicate the effect of this system level truncation is significant. This may be particularly true for the 35-Hz system cutoff frequency that is required by the space shuttle. From this study's findings, recommendations for areas of study with space shuttle payload systems are made.

TP-3220 April 1992  
Technique to Eliminate Computational Instability in Multibody Simulations Employing the Lagrange Multiplier. G. Watts. Structures and Dynamics Laboratory. N92-23436

This paper presents a programming technique to eliminate computational instability in multibody simulations that use the Lagrange multiplier. The computational instability occurs when the attached bodies drift apart and violate the constraints. The programming technique uses the constraint equation, instead of integration, to determine the coordinates that are not independent. Although the equations of motion are unchanged, a complete derivation of the incorporation of the Lagrange multiplier into the equation of motion for two bodies is presented. A listing of a digital computer program which uses the programming technique to eliminate computational instability is also presented. The computer program simulates a solid rocket booster and parachute connected by a frictionless swivel.

TP-3248 June 1992  
Effect of Type of Load on Stress Analysis of Thin-Walled Ducts. J.B. Min and P.K. Aggarwal. Structures and Dynamics Laboratory. N92-26669

The standard procedure for qualifying the design of duct (pipe) systems in the space shuttle main engine (SSME) has been fairly well defined. However, since pipe elbows are quite common and important in the SSME duct systems, a clear understanding of the detailed stress profile of the components is necessary for accurate structural and life assessments. This study was initiated to predict the stress profile at/near the tangent point along the cross section of the duct under various types of loads. Also, this study was further extended to understand the stiffening effect on stresses due to

pressure at the tangent point. The intention of this study was to identify the importance of selecting proper locations for mounting strain gauges and to utilize the obtained results to anchor dynamic models for accurate structural and life assessments of the SSME ducts under dynamic environment. The finite element method was utilized in this study.

TP-3249 June 1992  
Definition and Design of an Experiment to Test Raster Scanning With Rotating Unbalanced-Mass Devices on Gimbaled Payloads. W.D. Lightsey, D.C. Alhorn, and M.E. Polites. Structures and Dynamics Laboratory. N92-29677

This paper describes an experiment designed to test the feasibility of using rotating unbalanced-mass (RUM) devices for line and raster scanning gimbaled payloads, while expending very little power. The experiment is configured for ground-based testing, but the scan concept is applicable to ground-based, balloon-borne, and space-based payloads, as well as free-flying spacecraft. In this paper, the servos used in scanning are defined, the electronic hardware is specified, and a computer simulation model of the system is described. Simulation results are presented that predict system performance and verify the servo designs.

TP-3275 August 1992  
Gibbs Free Energy of Reactions Involving Si-C, Si<sub>3</sub>-N<sub>4</sub>, H<sub>2</sub>, and H<sub>2</sub>-O as a Function of Temperature and Pressure. M.A. Isham. Materials and Processes Laboratory. N92-31278

Silicon carbide (Si-C) and silicon nitride (Si<sub>3</sub>-N<sub>4</sub>) are considered for application as structural materials and coating in advanced propulsion systems including nuclear thermal. Three-dimensional Gibbs free energy surfaces were constructed for reactions involving these materials in H<sub>2</sub> and H<sub>2</sub>/H<sub>2</sub>-O. Free energy plots are functions of temperature and pressure. Calculations used the definition of Gibbs free energy where the spontaneity of reactions is calculated as a function of temperature and pressure.

Silicon carbide decomposes to Si and CH<sub>4</sub> in pure H<sub>2</sub> and forms a Si-O<sub>2</sub> scale in a wet atmosphere. Silicon nitride remains stable under all conditions. There was no apparent difference in reaction thermodynamics between ideal and Van der Waals treatment of gaseous species.

TP-3277

August 1992

Applications of FEM and BEM in Two-Dimensional Fracture Mechanics Problems. J.B. Min, B.E. Steeve, and G.R. Swanson. Structures and Dynamics Laboratory. N92-31280

A comparison of the finite element method (FEM) and boundary element method (BEM) for the solution of two-dimensional plane strain problems in fracture mechanics is presented in this paper. Stress intensity factors (SIF's) were calculated using both methods for elastic plates with either a single-edge crack or an inclined-edge crack. In particular, two currently available programs, ANSYS for finite element analysis and BEASY for boundary element analysis, were used.

TP-3282

September 1992

Reconfiguring the RUM Experiment to Test Circular Scanning With Rotating Unbalanced-Mass Devices on Gimballed Payloads. M.E. Polites and D.C. Alhorn. Structures and Dynamics Laboratory.

This paper describes a ground-based experiment designed to prove the concept of circular scanning a gimballed payload with rotating unbalanced-mass (RUM) devices. The experiment is a modified version of a similar experiment which demonstrates line and raster scanning with RUM's. In this paper, a description of the experiment hardware is presented, and a detailed design of the servos used in scanning is given. A computer simulation model of the entire system is discussed, and simulation results are included. These verify the servo designs and show the RUM's to be an extremely power-efficient method for circular scanning.

TP-3289

September 1992

Spacecraft Flight Control System Design Selection Process for a Geostationary Communication Satellite. C. Barret. Structures and Dynamics Laboratory.

The Earth's first artificial satellite, Sputnik I, slowly tumbled in orbit. The first U.S. satellite,

Explorer I, also tumbled out of control. Now, as we launch the Mars observer and the Cassini spacecraft, stability and control have become a higher priority. This paper reviews the flight control system design selection process using as an example a geostationary communication satellite which is to have a life expectancy from 10 to 14 years.

Disturbance torques including aerodynamic, magnetic, gravity gradient, solar, micrometeorite, debris, collision, and internal torques are assessed to quantify the disturbance environment so that the required compensating torques can be determined. Then control torque options including passive versus active, momentum control, bias momentum, spin stabilization, dual spin, gravity gradient, magnetic, reaction wheels, control moment gyros, nutation dampers, inertia augmentation techniques, three-axis control, reaction control system (RCS), and RCS sizing are considered. A flight control system design is then selected, and preliminary stability criteria met by the control gains selection.

TP-3303

September 1992

The Effects of Compressive Preloads on the Compression-After-Impact Strength of Carbon/Epoxy. MSFC Center Director's Discretionary Fund Final Report, Project No. P-11. A.T. Nettles and D.G. Lance. Materials and Processes Laboratory.

A preloading device was used to examine the effects of compressive prestress on the compression-after-impact (CAI) strength of 16-ply, quasi-isotropic carbon epoxy test coupons. T300/934 material was evaluated at preloads from 200 to 4,000 lb at impact energies from 1 to 9 joules. IM7/8551-7 material was evaluated at preloads from 4,000 to 10,000 lb at impact energies from 4 to 16 joules. Advanced design of experiments methodology was used to design and evaluate the test matrices. The results showed that no statistically significant change in CAI strength could be attributed to the amount of compressive preload applied to the specimen.



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| <p>CARTER, D.L. <span style="float: right;">ED62</span><br/> AKSE, J.R. <span style="float: right;">(Umpqua Research Co.)</span><br/> THOMPSON, J.<br/> JOLLY, C.D.<br/> Catalytic Oxidation for Treatment of Aqueous Organic Contaminants. For presentation at the SAE International Conference on Environmental Systems, Seattle, WA, July 13-16, 1992.</p> <p>CARTER, D.L. <span style="float: right;">ED62</span><br/> COLE, H. <span style="float: right;">(Boeing)</span><br/> HABERCOM, M.<br/> GRIFFITH, G. <span style="float: right;">(Sverdrup)</span><br/> SLIVON, L. <span style="float: right;">(Battelle)</span><br/> Determination of Organic Carbon and Ionic Accountability of Various Waste and Product Waters Derived From ECLSS Water Recovery Tests and Spacelab Humidity Condensate. For presentation at the SAE International Conference on Environmental Systems, Seattle, WA, July 13-16, 1992.</p> <p>CHANG, H.-P. <span style="float: right;">(Sverdrup)</span><br/> FRENCH, R.A. <span style="float: right;">EL58</span><br/> Dynamic Performance of an Aero-Assist Spacecraft—AFE. For presentation at the Second AAS/AIAA Space Flight Mechanics Conference, Colorado Springs, CO, February 24-26, 1992.</p> <p>CHAPMAN, J.S. <span style="float: right;">SA61</span><br/> NIX, M.B.<br/> Overview of the Manufacturing Sequence of the Advanced Solid Rocket Motor. For presentation at the AIAA 1992 Space and Technologies Conference, Huntsville, AL, March 24-26, 1992.</p> <p>CHAPPELL, C.R. <span style="float: right;">DS01</span><br/> KATZENBERGER, J.<br/> The Ground Truth Studies Project, A "Hands-On" Environmental Science Program for Students, Grades K-12. For presentation at the 43rd Congress of the International Astronautical Federation, Washington, DC, August 28-September 5, 1992.</p> <p>CHASSAY, R.P. <span style="float: right;">JA82</span><br/> Cooperation Between NASA and ESA for the First Microgravity Materials Science Glovebox. For presentation at the World Space Congress, Washington, DC, August 28-September 5, 1992.</p> | <p>CHEN, P.S. <span style="float: right;">(IIT Research)</span><br/> VESELY, E.J., JR.<br/> PANDA, B.<br/> HAMILTON, W.D. <span style="float: right;">EH22</span><br/> PARR, R.A.<br/> The LCF Behavior of the Ni-Base Superalloy PWA 1489 in Hydrogen. For presentation at the Seventh International Symposium on Superalloys, Seven Springs Mt. Resort, Champion, PA, September 20-24, 1992.</p> <p>CHEN, P.S. <span style="float: right;">EH23 (IIT Research)</span><br/> VESELY, E.<br/> PANDA, B.<br/> HAMILTON, W.D.<br/> PARR, R.A.<br/> The Low Cycle Fatigue and Tensile Behavior of Ni-Base Superalloys PWA 1480 and PWA 1489 in Hydrogen. For presentation at Hydrogen Effects on Materials in Propulsion Systems, MSFC, AL, May 20-21, 1992.</p> <p>CHENG, A.K. <span style="float: right;">(Sverdrup)</span><br/> REWINKEL, D.A.<br/> OWENS, S.F. <span style="float: right;">(CFD Research)</span><br/> SEYMOUR, D.C. <span style="float: right;">EP73</span><br/> Numerical Analysis of Propellant and Pressurant Flow in the TS116 Engine Component Test Stand at MSFC. For presentation at the ASME Fluids Conference, Washington, DC, June 20-24, 1993.</p> <p>CHENG, A.K. <span style="float: right;">(Sverdrup)</span><br/> MARSH, M.W. <span style="float: right;">EP62</span><br/> SSME Alternate High Pressure Oxidizer Turbopump Axial Thrust Balance and Secondary Flow Computer Model. For presentation at the ASME Fluids Conference, Washington, DC, June 20-24, 1993.</p> <p>CHOU, S.-J. <span style="float: right;">ES42</span><br/> Nonlinear Baroclinic Waves With Periodic Forcing. For presentation at the Eighth Southeastern Geophysical Fluid Dynamics Conference, Tallahassee, FL, March 13-14, 1992.</p> <p>CHOW, A.S. <span style="float: right;">EP55</span><br/> Numerical Modeling of NITM-2 Flow Field. For presentation at the 28th Joint Propulsion Conference, Nashville, TN, July 6-8, 1992.</p> |
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| <p><b>CHRISTIAN, H.J.</b> ES43<br/> <b>GOODMAN, S.J.</b><br/>         Global Observations of Lightning From Space. For presentation at the Ninth International Conference on Atmospheric Electricity, St. Petersburg, Russia, June 15-19, 1992.</p> <p><b>CHRISTIAN, P.M.</b> ED12<br/> <b>RAKOCZY, J.</b><br/>         MSFC Computational Controls Workstation. For presentation at the NASA/NSF/DoD Workshop on Aerospace Computational Control, Santa Barbara, CA, August 17-19, 1992.</p> <p><b>COHEN, C.</b> ES42<br/>         The Effects of the Hydrostatic Assumption and of Horizontal Grid Size on Numerical Simulations of Low-Level Mass Convergence. For publication in the Journal of the Atmospheric Sciences, Boston, MA.</p> <p><b>COOK, S.</b> PD24<br/> <b>HUETER, U.</b><br/>         Launch Vehicles for the Space Exploration Initiative. For presentation at the AIAA Space Programs and Technologies Conference, Huntsville, AL, March 24-27, 1992.</p> <p><b>COOPER, A.E.</b> EB22<br/> <b>POWERS, W.T.</b><br/> <b>WALLACE, T.L.</b><br/>         An OPAD Update: Investigation of SSME Component Erosion. For presentation at SAE Aerospace Atlantic, Dayton, OH, April 9, 1992.</p> <p><b>CORNETT, K.G.</b> EO33<br/>         A Step Towards Space Station User Operations. For presentation at the AIAA Space Programs and Technologies Conference, Huntsville, AL, March 24-27, 1992.</p> <p><b>COSTES, N.C.</b> ES42<br/> <b>STURE, S.</b><br/> <b>MCTIGUE, D.</b><br/>         Mechanics of Granular Materials at Very Low Effective Stress Levels. For presentation at the ASCE Engineering Mechanics Conference, College Station, TX, May 24-27, 1992.</p> <p><b>COWAN, J.R.</b> EP64<br/> <b>MYERS, W.N.</b><br/>         Design and Test of a High Power Electromechanical Actuator for Thrust Vector Control. For presentation at the AIAA/SAE/</p> | <p>ASME/ASEE 28th Joint Propulsion Conference, Nashville, TN, July 6-8, 1992.</p> <p><b>CRAMER, J.M.</b> EP53<br/>         Application of the Integrated Modular Engine (IME) to Space Vehicle Concepts. For presentation at the AIAA/SAE/ASME/ASEE 28th Joint Propulsion Conference, Nashville, TN, July 6-8, 1992.</p> <p><b>CRAVEN, P.D.</b> ES53<br/>         Comparison of a Physical Plasmaspheric Model (FLIP) With Measured Ionospheric/Plasmaspheric Plasma Composition and Temperature. For presentation at the Third Huntsville Workshop on Magnetosphere/Ionosphere Plasma Models, Guntersville, AL, October 5-8, 1992.</p> <p><b>CURRERI, P.A.</b> ES75<br/> <b>RAMACHANDRAN, N.</b><br/> <b>JONES, J.C.</b><br/> <b>DOWNEY, J.P.</b><br/>         Experimental Results and Numerical Modeling of Solidification During Aircraft High-g Arcs. For presentation at the AIAA 30th Aerospace Science Meeting, Reno, NV, January 6-9, 1992.</p> <p><b>CURRERI, P.A.</b> ES75<br/> <b>RAMACHANDRAN, N.</b><br/> <b>DOWNEY, J.P.</b><br/> <b>JONES, J.C.</b><br/>         Numerical Modeling of Melt Velocity and Thermal Distributions During Aircraft High-gravity Arcs. For publication in the Journal of Crystal Growth, Amsterdam, Netherlands.</p> <p><b>CUTTEN, D.R.</b> (UAH)<br/> <b>PEUSCHEL, R.</b> (Ames)<br/> <b>ROTHERMEL, J.</b> ES43<br/> <b>CLARKE, A.D.</b> (University of Hawaii)<br/> <b>BOWDLE, D.A.</b> (UAH)<br/>         Comparison of Measured and Modeled Scattering Parameters for Tropospheric Aerosols. For presentation at the American Association for Aerosol Research, San Francisco, CA, October 12-16, 1992.</p> <p><b>DABNEY, R.W.</b> ED13<br/>         Application of Neural Networks to Autonomous Rendezvous and Docking of Space Vehicles. For presentation at the AIAA Space Programs and Technology Conference, Huntsville, AL, March 25, 1992.</p> |
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| <p>DALINS, I. EH22<br/>KARIMI, M. (Alabama A&amp;M University)<br/>ILA, D.<br/>ARXPS Investigation of PTFE After Prolonged Space Exposure. For presentation at the American Vacuum Society, Seattle, WA, November 11-15, 1991.</p> <p>DALLEK, S. ER41<br/>DEITE, S.<br/>KAYSER, E.<br/>AUGL, J.M.<br/>SEIDEN, N.<br/>Characterization of UCAR C-34 and Dylon GC High Temperature Cements. For presentation at the JANNAF Interagency Propulsion Committee, Rocket Nozzle Technology Subcommittee Meeting, MSFC, AL, November 5-7, 1991.</p> <p>DAURO, V.A., SR. PD33<br/>IMP, A Performance Code. For presentation at the Automated Rendezvous and Capture Capabilities Review, Williamsburg, VA, November 19-21, 1991.</p> <p>DAVIS, D.J. EP55<br/>DILL, K.M. (Sverdrup)<br/>TARWATER, R.<br/>REWINKEL, D.A.<br/>One Versus Two Primary LOX Feedline Configuration Study for the National Launch System. For presentation at the 28th AIAA/SAE/ASME/ASEE Joint Propulsion Conference and Exhibit, Nashville, TN, July 6-8, 1992.</p> <p>DAVIS, H.W. ED12<br/>BUKLEY, A.P.<br/>Structural Control Sensors for the CASES GTF. For presentation at the Fifth Annual NASA/DoD CSI Technology Conference, Lake Tahoe, NV, March 3-5, 1992.</p> <p>DAVIS, J.M. ES52<br/>The Prediction of Solar Flares for the Space Exploration Initiative. For presentation at COSPAR, World Space Congress, Washington, DC, August 28-September 5, 1992.</p> <p>DEAN, D.L. (McDonnell Douglas)<br/>SEMMELE, M.L. EH33<br/>LITTLE, R.L. (MICOM)<br/>Chemical Basis for an Inert Propellant Exhibiting Good Bondline Characteristics</p> | <p>Developed for the Bondlines Task of the NAS Solid Propulsion Integrity Program (SPIP). For presentation at the JANNAF Propellant Development and Characterization Subcommittee Meeting, KSC, FL, April 7-9, 1992.</p> <p>DECHER, R. ES61<br/>PETERS, P.N.<br/>SISK, R.C.<br/>URBAN, E.W.<br/>VLASSE, M.<br/>RAO, D.K.<br/>High Temperature Superconducting Bearing for Rocket Engine Turbo Pumps. For presentation at the World Congress on Superconductivity, Munich, Germany, September 14-18, 1992.</p> <p>DECHER, R. ES61<br/>Space Science and Astronomy. For publication in AIAA Magazine, Aerospace America, Washington, DC, 1992.</p> <p>DELCOURT, D.C. ES53<br/>MOORE, T.E.<br/>SAUVAUD, J.A.<br/>Non-Adiabatic Transport Features in the Upper Cleft Region. For publication in JGR, Washington, DC.</p> <p>DEMOULIN, P. (Observatoire de Paris)<br/>VAN DRIEL-GESZTELYI, L. (Sterrekundig Instituut)<br/>SCHMIEDER, B. (Observatoire de Paris)<br/>HENOUX, J.C. (Observatoire de Paris)<br/>CSEURA, G. (Heliophysical Observatory)<br/>HAGYARD, M. ES52<br/>Evidence for Energy Release by Magnetic Reconnection in Solar Flares. For publication in Astronomy and Astrophysics, Reinhold, NY.</p> <p>DERRICKSON, J.H. ES62<br/>BENTON, E.V.<br/>HEINRICH, W.<br/>PARNELL, T.A.<br/>ARMSTRONG, T.W.<br/>ET AL.<br/>Ionizing Radiation Exposure of LDEF (Pre-Recovery Estimates). For publication in Nuclear Tracks and Radiation Measurement, Pergamon Press, Oxford, England.</p> <p>DERRICKSON, J.H. ES62<br/>PARNELL, T.A.</p> |
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| <p>AUSTIN, R.W.<br/>SELIG, W.J.<br/>GREGORY, J.C.<br/>A Measurement of the Absolute Energy Spectra of Galactic Cosmic Rays During the 1976-77 Solar Minimum. For publication in Nuclear Tracks and Radiation Measurements, San Francisco, CA.</p>  | <p>DUGAL-WHITEHEAD, N. EB12<br/>JOHNSON, Y.B.<br/>Results of an Electrical Power System Fault Study. For presentation at the Intersociety Energy Conversion Engineering Conference, San Diego, CA, August 3-7, 1992.</p>   |
| <p>DESANCTIS, C. PS02<br/>Science and Application Missions of the Near Future. For presentation at the AIAA Space Programs and Technologies Conference, Huntsville, AL, March 24-27, 1992.</p>   | <p>EDWARDS, D.L. EH15<br/>SEMMELE, C.<br/>SIMS, J.<br/>MCDONALD, K.<br/>WERTZ, G.<br/>MCCAIN, M.<br/>ZWIENER, J.<br/>Multi-Accelerator Systems for Combined Space Environmental Exposure of Materials. For presentation at the International Conference on the Application of Accelerators in Research and Industry, Denton, TX, November 2-5, 1992.</p> |
| <p>DESANCTIS, C.E. PS02<br/>DABBS, J.R.<br/>JOHNSON, C.L.<br/>ROBERTS, W.T.<br/>Small to Intermediate Satellites for Future Space Physics Missions. For presentation at The World Space Congress, IAF, Symposium on Earth Observations, Washington, DC, August 28-September 5, 1992.</p> | <p>ELFER, N. ED52<br/>ROBERTS, B.<br/>OLSEN, G.<br/>Space Debris Surfaces: Probability of No Penetration Versus Impact Velocity and Obliquity. For presentation at the AIAA Space Programs and Technologies Conference, Huntsville, AL, March 24-27, 1992.</p>   |
| <p>DIETZ, K.L. ES65<br/>RAMSEY, B.D.<br/>WEISSKOPF, M.C.<br/>The Performance of a Multistep Fluorescence-Gated Proportional Counter for Hard X-Ray Astronomy. For presentation at SPIE's International Symposium on Optical Applied Science and Engineering.</p>                         | <p>ELFER, N.C. (Martin Marietta)<br/>BAILLIF, F.<br/>ROBINSON, J. ED52<br/>External Tank Space Debris Considerations. For presentation at the AIAA Space Programs and Technologies Conference, Huntsville, AL, March 24-27, 1992.</p>  |
| <p>DING, R.J. EE24<br/>TQM Initiatives in Space Shuttle Main Engine (SSME) Manufacturing. For presentation at the 28th Annual AIAA/SAE/ASME/ASEE Propulsion Conference, Nashville, TN, July 6-8, 1992.</p>   | <p>ELROD, S.E. KA40<br/>A Policy of Standardization for Satellite Retrieval Systems. For presentation at the Space Assembly and Servicing Working Group Interface Standards Meeting and Exhibition, Houston, TX, November 13-14, 1991.</p>   |
| <p>DOWNEY, J. ES74<br/>Static and Dynamic Scaling Properties of Single, Self-Avoiding Polymer Chains in Two-Dimensions Via the Bond Fluctuation Method of Monte Carlo Simulation. For publication in Macromolecules, Murray Hill, NJ.</p>  | <p>ELSNER, R.F. ES65<br/>O'DELL, S.L.<br/>Mirror Coating Optimization for Grazing Incidence X-Ray Optics at the Iron Line Complex Between 6 and 7 keV. For presentation at SPIE's Multilayer and Grazing Incidence X-Ray/EUV Optics for Astronomy and Projection Lithography, San Diego, CA, July 19-24, 1992.</p>                                       |
| <p>DUGAL-WHITEHEAD, N. EB12<br/>Large Autonomous Spacecraft Electrical Power System (LASEPS). For presentation at the Intersociety Energy Conversion Engineering Conference, San Diego, CA, August 3-7, 1992.</p>  |  |

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| <p>EMRICH, W.J., JR. PD13<br/>YOUNG, A.C.<br/>MULQUEEN, J.A.<br/>Vehicle Configuration Studies Using Nuclear Propulsion for Mars Missions. For presentation at the AIAA Space Programs and Technology Conference, Huntsville, AL, March 24, 1992.</p> <p>FAWCETT, S.C. EB23<br/>DOW, T.A.<br/>Influence of Wheel Speed on Surface Finish and Chip Geometry in Precision Contour Grinding. For publication in Precision Engineering Journal of the ASPE, Raleigh, NC, March 1, 1992.</p> <p>FAWCETT, S.C. EB23<br/>DOW, T.A.<br/>Analysis of the Wheel Speed Effects in Precision Contour Grinding. For presentation at the American Society for Precision Engineering, Santa Fe, NM, October 17, 1991.</p> <p>FAWCETT, S.C. ED23<br/>ROOD, R.W.<br/>BIFANO, T.G. (Boston University)<br/>EGERT, C. (Oak Ridge Lab)<br/>Surface Characteristics of Ion Milled CVD SiC. For presentation at the American Society for Precision Engineering Conference, Orlando, FL, October 18-23, 1992.</p> <p>FAY, J.F. (Sverdrup)<br/>KUMAR, G.N.<br/>SEAFORD, C.M. ED33<br/>Aerothermodynamic Environment Predictions in Support of the Aeroassist Flight Experiment. For publication in the Journal of Spacecraft and Rockets, American Institute of Aeronautics and Astronautics.</p> <p>FEARS, S.D. EP62<br/>GIBSON, H.G.<br/>Rolling Element Bearing Tests Performed in Liquid Oxygen. For presentation at the AIAA/SAE/ASME/ASEE 28th Joint Propulsion Conference, Nashville, TN, July 6-8, 1992.</p> <p>FINESCHI, S. ES52<br/>DEGL'INNOCENTI, E.L. (University of Spain)<br/>Electron Impact Polarization of Atomic Spectral Lines. I. A General Theoretical Scheme. For publication in The Astrophysical Journal, Chicago, IL.</p> | <p>FISHMAN, G.J. ES62<br/>MEEGAN, C.A.<br/>WILSON, R.B.<br/>PACIESAS, W.S. (UAH)<br/>PENDLETON, G.N.<br/>HARMON, B.A. ES62<br/>HORACK, J.M.<br/>BROCK, M.N.<br/>KOUVELIOTOU, C. (USRA)<br/>FINGER, M. ES62<br/>Overview of Observations From BATSE on the Compton Observatory. For publication in Astronomy and Astrophysics, Meudon, France.</p> <p>FISHMAN, G.J. ES62<br/>Gamma-Ray Astronomy. For publication in McGraw-Hill Yearbook of Science and Technology, New York, NY, 1994.</p> <p>FISHMAN, G.J. ES62<br/>BATSE/Compton Observations of Gamma-Ray Bursts. For presentation at the Compton Observatory Symposium, St. Louis, MO, October 15-18, 1992.</p> <p>FISHMAN, G.J. ES62<br/>Observations From the BATSE Experiment on the Compton Observatory. For presentation at the Spring Meeting of The American Physical Society, Washington, DC, April 1992.</p> <p>FISHMAN, G.J. ES62<br/>Gamma-Ray Observations of the Crab Pulsar—Past, Present, Future. For publications in the Annals of the New York Academy of Sciences, New York, NY.</p> <p>FISHMAN, G.J. ES62<br/>Gamma-Ray Burst Observations From the Gamma Ray Observatory: Capabilities and Early Results. For presentation at the Colloquium University of Toronto, Toronto Ontario, Canada, November 7-8, 1991.</p> <p>FISHMAN, G.J. ES62<br/>Initial Observations From the BATSE Experiment on the Compton Gamma Ray Observatory. For presentation at the 179th Meeting of the American Astrophysical Society, Atlanta, GA, January 12-16, 1992.</p> |
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| <p>FOGLE., F.R. EL56<br/>WOODRUFF, L.D.<br/>Definition of and Training in the Systems Engineering Process—A NASA Perspective. For presentation at the Second Annual Symposium of the National Council on Systems Engineering (NCOSE), Seattle, WA, July 20–22, 1992.</p> <p>FONTENALA, J.M. ES52<br/>RABIN, D.<br/>HATHAWAY, D.H.<br/>MOORE, R.L.<br/>Measurement of P-Mode Energy Propagation in the Quiet Solar Photosphere. For publication in The Astrophysical Journal, Chicago, IL.</p> <p>FOUNTAIN, J.A. PS01<br/>Overview of Commercial Research Activities. For presentation at the Space Station <i>Freedom</i> Utilization Conference, Huntsville, AL, August 3–6, 1992.</p> <p>FOX, T. ED14<br/>A Description of the SAFD System Hardware. For presentation at the Third Annual Health Monitoring Conference for Space Propulsion Systems, Cincinnati, OH, November 13–14, 1991.</p> <p>FRANCK, C.G. ED25<br/>Analyses of the Turbine Blades for the Space Shuttle Main Engines, Part 3—Steady State Stress and High Cycle Fatigue Analysis. For presentation at the 1992 ASME International Gas Turbine Conference, Cologne, Germany, May 31–June 4, 1992.</p> <p>FREHLICH, R. EB23<br/>Cramer-Rao Bound for Gaussian Random Processes and Applications to Radar Processing of Atmospheric Signals. For publication in IEEE Transactions on Acoustics, Speech, and Signal Processing, New York, NY.</p> <p>FULTON, M.A. ES65<br/>KOLODZIEJCZAK, J.<br/>RAMSEY, B.D.<br/>Microstrip Proportional Counter Development at MSFC. For presentation at SPIE's EUV, X-Ray, and Gamma-Ray Instrumentation for Astronomy III, San Diego, CA, July 19–24, 1992.</p> | <p>GALLAGHER, D.L. ES53<br/>Core Plasma in the Magnetosphere. For presentation at the Third Huntsville Workshop on Magnetosphere/Ionosphere Plasma Models, Guntersville, AL, December 5–8, 1992.</p> <p>GAMWELL, W.R. EH23<br/>KURUVILLA, A.K.<br/>Squeeze Castings for Advanced Propulsion Engine Components. For presentation at the Seventh International Symposium on Superalloys, Champion, PA, September 20–24, 1992.</p> <p>GARCIA, R. ED32<br/>MCCONNAUGHEY, P.<br/>EASTLAND, A.<br/>Activities of the NASA/Marshall Space Flight Center (MSFC) Pump Stage Technology Team. For presentation at the 28th AIAA/SAE/ASME/ASEE Joint Propulsion Conference, Nashville, TN, July 6–8, 1992.</p> <p>GARCIA, R. ED32<br/>JACKSON, E.<br/>SCHUTZENHOFER, L.A.<br/>A Summary of the Activities of the NASA/MSFC Pump Stage Technology Team. For presentation at the Fourth International Symposium on Transport Phenomena and Dynamics of Rotating Machinery, Honolulu, HI, April 5–8, 1992.</p> <p>GARY, G.A. ES52<br/>POLETTI, G.<br/>MACHADO, M.E.<br/>Interacting Confined-Eruptive Flare Sites Within a Magnetic Active Region Complex. For presentation at the AAS/Solar Physics Annual Meeting, Columbus, OH, June 7–11, 1992.</p> <p>GILES, B.L. ES53<br/>CHAPPELL, C.R.<br/>MOORE, T.E.<br/>COMFORT, R.H. (UAH)<br/>IMF Influence on Low-Energy Plasma Outflow in the Auroral Zone Polar Cap and Cusp. For presentation at the Third Huntsville Workshop on Magnetosphere/Ionosphere Plasma Models, Guntersville, AL, October 5–8, 1992.</p> |
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| <p>GILLEY, S.D. (Sverdrup)<br/>KNOX, J.C. ED62<br/>Performance Predictions of Space Station <i>Freedom</i> ECLSS Cabin Air Handling Subsystems for the Man Tended Configuration. For presentation at the International Conference on Life Support and Biospherics, Huntsville, AL, February 18-20, 1992.</p> <p>GOGGIN, D.G. (Sverdrup)<br/>DARDEN, J.M. ED14<br/>Limiting Critical Speed Response on the SSME Alternate High Pressure Fuel Turbopump (ATD HPFTP) With Bearing Deadband. For presentation at the AIAA 28th Joint Propulsion Conference, Nashville, TN, July 6-9, 1992.</p> <p>GOLBEN, J. (Science and Technology Corp.)<br/>VLASSEE, M. ES74<br/>Melt-Sintering Process Optimization at Temperatures Below 1,100 °C for YBa<sub>2</sub>Cu<sub>3</sub>O<sub>7</sub> and Bulk Samples. For publication in Superconductivity Science and Technology, Bristol, UK.</p> <p>GOLBEN, J. (Science and Technology Corp.)<br/>VLASSEE, M. ES74<br/>Study of Bulk and Single Crystal YBa<sub>2-x</sub>Sr<sub>x</sub>-Cu<sub>3</sub>O<sub>7-o</sub> Superconducting Materials. For publication in Superconductor Science and Technology, United Kingdom.</p> <p>GOLDBERG, B.E. EP54<br/>COOK, J.R.<br/>Preliminary Results of the NASA/Industry Hybrid Propulsion Program. For presentation at the AIAA Joint Propulsion Conference, Nashville, TN, July 6-8, 1992.</p> <p>GOLDBERG, B.E. EP54<br/>WILEY, D. (General Dynamics)<br/>ESTEY, P. (American Rocket)<br/>Hybrid Rockets: Combining the Best of Liquid and Solids. For publication in Aerospace America, Washington, DC, July 1992.</p> <p>GOODMAN, H.M. ES44<br/>Science Data Processing in the Mission to Planet Earth Era. For presentation at the AIAA Space Programs and Technologies Conference, Huntsville, AL, March 25, 1992.</p> | <p>GREGORY, J.C. (UAH)<br/>PETERS, P.N. ES64<br/>Angular Distributions of 5-eV Atomic Oxygen Scattered From Solid Surface on the LDEF Satellite. For publication in Proceedings to Rarefied Gas Dynamics, Department of Chemistry, University of British Columbia, Vancouver, BC, Canada, July 26-31, 1992.</p> <p>GREGORY, J. EB42<br/>DEWBERRY, B.<br/>GUILLEBEAU, M.<br/>TROY, J.<br/>LANFEAR, T.<br/>MCKINNEY, K.<br/>Development of a Pilot Project Following the Spiral Model of Software Development. For presentation at the NASA/GSFC Software Engineering Lab, 16th Annual Software Engineering Workshop, Greenbelt, MD, December 4-5, 1991.</p> <p>GREINER, B. EP54<br/>FREDERICK, R.A., JR.<br/>Results of Labscale Hybrid Rocket Motor Investigation. For presentation at the 28th AIAA/SAE/ASME/ASEE Joint Propulsion Conference, Nashville, TN, July 6-8, 1992.</p> <p>GRIFFIN, L.W. ED32<br/>HUBER, F.W. (Pratt and Whitney)<br/>BACHE, G. (Aerojet)<br/>Turbine Design Technology Team: An Overview of Current and Planned Activities Relevant to the National Launch System (NLS). For presentation at the 28th AIAA/SAE/ASME/ASEE Joint Propulsion Conference, Nashville, TN, July 6-8, 1992.</p> <p>GRIFFIN, L. ED32<br/>ROWEY, R.J.<br/>Analyses of Turbine Blades for Space Shuttle Main Engines (SSME) Part I—Aerodynamic Environment. For presentation at the 1992 ASME International Gas Turbine Conference, Cologne, Germany, May 31-June 4, 1992.</p> <p>GRINER, C. EO01<br/>LEWIS, C.<br/>SMITH, K.<br/>Payload Training for the Space Station <i>Freedom</i> ERA. For presentation at the World Space Congress, Washington, DC, August 28-September 5, 1992.</p> |
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| <p>GRINER, C. EO01<br/>Space Station <i>Freedom</i> Payload Operations in the 21st Century. For presentation at the 42nd International Astronautical Congress, Montreal, Canada, October 7-11, 1991.</p> <p>GROFF, M.B. (Teledyne Brown)<br/>MUSICK, B.Q. EJ22<br/>WRIGHT, M.E. EL64<br/>Spacelab Glovebox. For presentation at the American Glovebox Society, Albuquerque, NM, August 17, 1992.</p> <p>GUILLORY, A. ES43<br/>JEDLOVEC, G.<br/>FUELBERG, H.E.<br/>A Technique for Deriving Column-Integrated Water Content Using VAS Split-Window Data. For publication in the Journal of Applied Meteorology, Boston, MA, May 1993.</p> <p>HAGYARD, M.J. ES52<br/>MACHADO, M.E.<br/>SCHMIEDER, B.<br/>DEMOULIN, P.<br/>GUOXIANG, A.<br/>QIJUN, F.<br/>XIANG, S.L.<br/>KAI, L.Z.<br/>KALMAN, B.<br/>Relationship Between Magnetic Field Evolution and Flaring Sites in AR 6659 on June 1991. For presentation at COSPAR, Washington, DC, August 28-September 9, 1992.</p> <p>HAGYARD, M.J. ES52<br/>WEST, E.A.<br/>SMITH, J.E.<br/>Magnetic Field Changes Associated With a Sub-Flare and Surge. For publication in Solar Physics, Dordrecht, The Netherlands.</p> <p>HALE, J.P., II EO23<br/>Marshall Space Flight Center's Virtual Reality Applications Program. For presentation at Wescon/92 Technical Conference, Anaheim, CA, November 17-19, 1992.</p> <p>HALE, J.P., II EO23<br/>Assessment of Head-Mounted Miniature Monitor. For presentation at the Human Factors Society 36th Annual Meeting, Atlanta, GA, October 12-16, 1992.</p> | <p>HALE, J.P. EO23<br/>Anthropomorphic Teleoperation: Controlling Remote Manipulators With the DataGlove. For presentation at the Human Factors Society 36th Annual Meeting, Atlanta, GA, October 12-16, 1992.</p> <p>HAMMER, R. ES52<br/>MOORE, R.L.<br/>Heating Times and Heating Mechanisms in the Quiet Solar Atmosphere. For publication in American Astronomical Society Bulletin, Washington, DC.</p> <p>HAMMOND, W.E. (Sverdrup)<br/>JONES, W.G. EL56<br/>Vehicle Health Management Technology Needs. For presentation at the AIAA Space Programs and Technologies Conference, Huntsville, AL, March 24-27, 1992.</p> <p>HANSON, J.M. EL58<br/>SHRADER, M.W.<br/>CHANG, H.P. (Sverdrup)<br/>FREEMAN, S.<br/>Guidance and Dispersion Studies of National Launch System Ascent Trajectories. For presentation at the AIAA/AAS Guidance, Navigation, and Control Conference, Hilton Head, SC, August 10-12, 1992.</p> <p>HANSON, J.M. EL58<br/>Mars Parking Orbit Selection. For publication in the Journal of the Astronautical Sciences, Springfield, VA.</p> <p>HARMON, B.A. ES62<br/>WILSON, R.B.<br/>FINGER, M.H.<br/>PACIESAS, W.S.<br/>RUBIN, B.C.<br/>FISHMAN, G.J.<br/>X-Ray Nova 4U1543-47. For publication in Central Bureau for Astronomical Telegrams, International Astronomical Union, Cambridge, MA.</p> <p>HARMON, B.A. ES62<br/>PACIESAS, W.S.<br/>RUBIN, B.<br/>FINGER, M.H.<br/>FISHMAN, G.J.<br/>WILSON, R.B.<br/>MEEGAN, C.A.</p> |
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Galactic Center. For publication in the Central Bureau for Astronomical Telegrams, International Astronomical Union, Cambridge, MA.

Early Results From Occultation Analysis of BATSE/GRO Data. For presentation at the 179th AAS Meeting, Atlanta, GA, January 13-16, 1992.

HARMON, B.A. ES62  
WILSON, C.A.  
BROCK, M.N.  
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RUBIN, B.C. ES62  
FINGER, M.H. (UAH)

Earth Occultation Measurements of Galactic Hard X-Ray/Gamma-Ray Sources: A Survey of BATSE Results. For presentation at the Compton Observatory Symposium, St. Louis, MO, October 15-17, 1992.

HARMON, B.A. ES62  
WILSON, C.A.  
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Observation of a Hard State Outburst in the GX339-4 System. For presentation at the Compton Observatory Symposium, St. Louis, MO, October 15-17, 1992.

HARMON, B.A. ES62  
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WILSON, R.B.  
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BENTON, E.V.  
FRANK, A.L.

LDEF Radiation Measurements: Preliminary Results. For publication in Nuclear Tracks and Radiation Measurements, Pergamon Press, Headington Hill Hall, Oxford, England.

HARRISON, J.K. FA34  
RUPP, C.C. PS04  
Orbiting Transmitter and Antenna for Spaceborne Communications at ELF/VLF to Submerged Submarines. For presentation at the ELF/VLF/LF Radio Propagation and Systems Aspects, Brussels, Belgium, September 28-October 2, 1992.

HATHAWAY, D.H. ES52  
Doppler Measurement of the Solar Meridional Circulation. For presentation at the AAS/Solar Physics Annual Meeting, Columbus, OH, June 7-11, 1992.

HAWARDEN, T.G. ES63  
CUMMINGS, R.O.  
TELESCO, C.M.  
Optimized Radiative Cooling of Infrared Space Telescopes. For publication in the Proceedings of The Next Generation Infrared Telescope Meeting, Royal Observatory, Edinburgh, United Kingdom, May 22-24, 1991.

HE, X.M. ES76  
CARTER, D.C.  
Atomic Structure and Chemistry of Human Serum Albumin. For publication in Nature, London, England.

HE, X.M. ES76  
Internal Vibrations of a Molecule Consisting of Rigid Segments I, Non-Interacting Internal Vibrations. For publication in Acta Crystallographica, Winterstoke Rd., Bristol, England.



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| <p>HEAMAN, J.P. <span style="float: right;">ED35</span><br/>Experiences With A High-Pressure Scanning System. For presentation at the 77th Semiannual Meeting of the Supersonic Wind Tunnel Association, Notre Dame, IN, April 10-15, 1992.</p>  | <p>HILL, S.A. <span style="float: right;">ED52</span><br/>HERTEL, E.S. (Sandia National Laboratory)<br/>CHHABILDAS, L.C.<br/>Whipple Bumper Shield Test at 10.3 km/s. For presentation at the Topical Conference on Shock Waves in Condensed Matter, Williamsburg, VA, June 17-20, 1991.</p>                        |
| <p>HELMICKI, A.J. <span style="float: right;">ED14</span><br/>VALLELY, D.P.<br/>KUO, F.Y.<br/>On the Development of System-Theoretic Tools for the Design of Integrated Health Monitoring and Controls for Rocket Propulsion Systems. For presentation at the Third Annual Health Monitoring Conference for Space Propulsion System, Cincinnati, OH, November 13-14, 1991.</p> | <p>HINMAN, E.M. <span style="float: right;">EB24</span><br/>Development of a Test Protocol for Evaluating EVA Glove Performance. For presentation at the 22nd International Conference on Environmental Systems, Seattle, WA, July 13-16, 1992.</p>   |
| <p>HERREN, B.J. <span style="float: right;">JA84</span><br/>Growing Protein Crystals in Microgravity, The NASA MSAD Protein Crystal Growth (PCG) Program. For presentation at the World Space Congress, Washington, DC, August 28-September 5, 1992.</p>   | <p>HOLDER, D.W. <span style="float: right;">ED62</span><br/>BAGDIGIAN, R.M.<br/>Phase III Integrated Water Recovery Testing at MSFC: Closed Hygiene and Potable Loop Results and Lessons Learned. For presentation at the SAE International Conference on Environmental Systems, Seattle, WA, July 13-16, 1992.</p> |
| <p>HERRMANN, M.C. <span style="float: right;">PD24</span><br/>JOHNSON, C.L. <span style="float: right;">PS02</span><br/>Spacecraft Design Considerations for an Inner Magnetosphere Imager Mission. For presentation at SPIE's 1992 International Symposium on Optical Applied Science and Engineering, San Diego, CA, July 19-24, 1992.</p>                                   | <p>HOOD, R.E. <span style="float: right;">ES43</span><br/>SPENCER, R.W.<br/>LAFONTAINE, F.J.<br/>Precipitation Remote Sensing Using the Advanced Microwave Precipitation Radiometer. For presentation at the 11th International Conference on Clouds and Precipitation, Montreal, Canada, August 16-22, 1992.</p>   |
| <p>HIGGINS, G.R. <span style="float: right;">EO44</span><br/>Computer Interfaces for the Visually Impaired. For presentation at Technology 2001, San Jose, CA, December 3-5, 1991.</p>   | <p>HOOVER, R. <span style="float: right;">ES52</span><br/>Advanced Optical Systems for Imaging Hard X-Rays and Gamma-Rays. For presentation at SPIE's International Symposium on Optical Applied Science and Engineering, San Diego, CA, July 19-24, 1992.</p>  |
| <p>HILL, S.A. <span style="float: right;">ED52</span><br/>HERTEL, E.S. (Sandia National Laboratory)<br/>CHHABILDAS, L.C.<br/>Whipple Bumper Shield Simulations. For presentation at the Topical Conference on Shock Waves in Condensed Matter, Williamsburg, VA, June 17-20, 1991.</p>   | <p>HOOVER, R.B. <span style="float: right;">ES52</span><br/>Multilayer X-Ray Optics as Momentum Filters. For presentation at the International Symposium on Optical Applied Science and Engineering, San Diego, CA, July 19-24, 1992.</p>   |
| <p>HILL, S.A. <span style="float: right;">ED52</span><br/>CHHABILDAS, L.C.<br/>HERTEL, E.S.<br/>A Comparison of Whipple Shield Hypervelocity Impact Tests to Penetration Predictors. For presentation at the 42nd International Astronautical Congress, Montreal, Canada, October 5-11, 1991.</p>  | <p>HOOVER, R.B. <span style="float: right;">ES52</span><br/>Imaging Schwarzschild Multilayer X-Ray Microscope. For presentation at the International Symposium on Optical Applied Science and Engineering, San Diego, CA, July 19-24, 1992.</p>   |

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| <p>HOOVER, R.B. ES52<br/>FINESCHI, S.<br/>Design and Fabrication of the All-Reflecting H-Lyman Coronagraph/Polarimeter. For presentation at the International Symposium on Optical Applied Science and Engineering, San Diego, CA, July 19-24, 1992.</p> <p>HOPPE, D.T. EH01<br/>Automated Carbon Dioxide Cleaning System. For presentation at Technology 2001, San Jose, CA, December 2-5, 1991.</p> <p>HORACK, J.M. ES62<br/>HAKKILA, J. (Mankato State University)<br/>FISHMAN, G.J.<br/>MEEGAN, C.A.<br/>WILSON, R.B.<br/>PACIESAS, W.S. (UAH)<br/>PENDLETON, G.N.<br/>BROCK, M.N. ES62<br/>KOUVELIOTOU, C. (Univ. of Athens, Greece)<br/>BRIGGS, M.S. (UAH)<br/>Preliminary Angular Correlation Analyses of Gamma-Ray Bursts Detected by BATSE. For presentation at Compton Observatory Symposium, St. Louis, MO, October 15-17, 1992.</p> <p>HORACK, J.M. ES62<br/>HARMON, B.A.<br/>FISHMAN, G.J.<br/>MEEGAN, C.A.<br/>WILSON, R.B.<br/>PACIESAS, W.S. (UAH)<br/>PENDLETON, G.N.<br/>KOUVELIOTOU, C.<br/>A Search for Long-Lived Emission From Well-Localized Gamma-Ray Bursts Using the BATSE Occultation Technique. For presentation at Compton Observatory Symposium, St. Louis, MO, October 15-17, 1992.</p> <p>HORACK, J.M. ES62<br/>KOSHUT, T.M. (UAH)<br/>MALLOZZI, R.S.<br/>STOLLBERG, M.<br/>STOREY, S.D. ES62<br/>FISHMAN, G.J.<br/>MEEGAN, C.A.<br/>WILSON, R.B.<br/>PACIESAS, W.S. (UAH)<br/>BATSE Observations of Gamma-Ray Bursts in Sun-Referenced Coordinate Systems. For</p> | <p>presentation at Compton Observatory Symposium, St. Louis, MO, October 15-17, 1992.</p> <p>HORACK, J.M. ES62<br/>MEEGAN, C.A.<br/>FISHMAN, G.J.<br/>WILSON, R.B.<br/>PACIESAS, W.S.<br/>EMSLIE, A.G.<br/>Effects of Location Uncertainties on the Observed Distribution of Bursts Detected by BATSE. For presentation at Compton Observatory Symposium, St. Louis, MO, October 15-17, 1992.</p> <p>HORACK, J.M. ES62<br/>MEEGAN, C.A.<br/>FISHMAN, G.J.<br/>WILSON, R.B.<br/>BROCK, M.N.<br/>PACIESAS, W.S. (UAH)<br/>KOUVELIOTOU, C. (USRA)<br/>Angular Distributions From Sub-Sets of Localized Gamma Ray Bursts Detected by BATSE. For presentation at the 179th Meeting of AAS, Atlanta, GA, January 13-16, 1992.</p> <p>HOWARD, R.T. EB24<br/>BOOK, M.L.<br/>Video Guidance Sensor for Automated Capture. For presentation at the AIAA Space Programs and Technology Conference, Huntsville, AL, March 24-27, 1992.</p> <p>HOWARD, S. ES62<br/>PENDLETON, G.<br/>Current Status of GRO/BATSE Correlation Between BATSE GRB's and H II Regions. For presentation at the 23rd Meeting of Division on Dynamical Astronomy (DDA)/HAD AAS, Chicago, IL, June 3-6, 1992.</p> <p>HOWARD, S. ES62<br/>The GTO/BATSE Data Analysis System. For publication in Proceedings of First Annual Conference on Astronomical Data Analysis Software and Systems, Tucson, AZ, November 6-8, 1991.</p> <p>HUBER, W.G. PA01<br/>Space Transportation Requirements/Systems. For presentation at the Ninth Symposium on</p> |
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- Space Nuclear Power Systems, Albuquerque, NM, January 12-16, 1992.
- HUFF, T.L. (Sverdrup)  
OBENHUBER, D.C.  
RODGERS, E.B. EH32  
SMITHERS, G.A.  
On-Line Monitoring of Biofilm Removal Using Iodine and Ozone Disinfectant Regimes. For presentation at the International Conference on Environmental Systems, Seattle, WA, July 1992.
- HUMPHRIES, W.R. ED61  
Interdisciplinary Analysis From the Spacecraft Thermal Analyst's Viewpoint. For presentation at the International Conference for Environmental Sciences (ICES), Seattle, WA, July 1992.
- HUMPHRIES, W.R. ED61  
Life Support System Design for the Space Station *Freedom* (S.S. *Freedom*). For presentation at the Fourth European Symposium for Space Station Environmental Control Systems, Florence, Italy, October 21-25, 1991.
- HUNG, R.J. (UAH)  
PAN, H.L.  
LEE, C.C.  
LESLIE, F.W. ES42  
Effect of Asymmetric Gravity Jitter Excited Slosh Waves at Liquid-Vapor Interface Under Microgravity. For publication in the Journal of Fluid Mechanics, Cambridge, United Kingdom.
- HUNG, R.J. ES42  
PAN, H.L.  
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Slosh-Wave-Excited Asymmetric Spacecraft Fluid Propellant Viscous Stress and Moment. For publication in the Journal of Propulsion and Power, Washington, DC.
- HUNG, R.J. ES42  
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Asymmetric Gravity Jitter Excited Slosh Waves and Spacecraft Moment and Angular Momentum Fluctuations. For publication in the Journal of Guidance, Control, and Dynamics, Washington, DC.
- HUNG, R.J. (UAH)  
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- LESLIE, F.W. ES42  
Similarity Rules in Gravity Jitter-Related Spacecraft Liquid Propellant Slosh Waves Excitation. For publication in the Journal of Fluid Structures, Montreal, Canada.
- HUNG, R.J. (UAH)  
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Longitudinal and Transverse Modes of Slosh Wave Excitation in Rotating Dewar Associated With Gravity Jitters. For publication in Acta Astronautica, Paris, France.
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Gravity Probe-B Spacecraft Attitude Control Based on the Dynamics of Slosh Wave-Induced Fluid Stresses Distribution on Rotating Dewar Container of Cryogenic Propellant. For publication in Acta Astronautica, Paris, France.
- IRWIN, R.D. ED12  
FRAZIER, W.G.  
MITCHELL, J.R.  
MEDINA, E.A.  
BUKLEY, A.P.  
Control System Design for Flexible Structures Using Data Models. For presentation at the Fifth NASA/NSF/DoD Workshop on Aerospace Computation Control, Santa Barbara, CA, August 17-19, 1992.
- ISHAM, M.A. EH34  
Temperature-Pressure Effects of Hydrogen on Room Temperature Flexural Strength of SiC and Si<sub>3</sub>N<sub>4</sub>. For presentation at the 1992 Conference on Advanced Earth-to-Orbit Propulsion Technology, Huntsville, AL, May 21, 1992.
- JACOBS, R. EH23  
VESELY, E.J., JR.  
Hydrogen Trapping in Superalloys. For presentation at Hydrogen Effects on Materials in Propulsion Systems, MSFC, AL, May 20-21, 1992.
- JARZEMBSKI, M.A. ES43  
SRIVASTAVA, V.  
Pressure Dependence of Laser-Induced Breakdown of Water Droplets. For publication in Optics Letters, Washington, DC.

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| JAYATIRTHA, H.N.<br>HENDERSON, D.O.<br>BURGER, A.<br>VOLZ, M.P.<br>A Study of Tellurium Precipitates in CdTe Crystals. For publication in the Journal of Applied Physics Letters, Argonne, IL.  | ES75          | ference, Technology 2001, San Jose, CA, December 3-5, 1991.  |                  |
| JOHNSON, C.L.<br>DIETZ, K.L.<br>ARMSTRONG, T.W.<br>COLBORN, B.L.<br>Mitigation of Adverse Environmental Effects on Lunar-Based Astronomical Instruments. For presentation at the Third International Conference on Engineering, Construction, and Operations in Space, Denver, CO, May 31-June 4, 1992. | PS02          | JONES, C.S.<br>HOFFMAN, D.S.<br>LAWLESS, K.G.<br>Robotic Welding at the Marshall Space Flight Center. For presentation at the AIAA Space Programs/Technology Conference, Huntsville, AL, March 24-26, 1992.                                | EH42             |
| JOHNSON, D.L.<br>HILL, C.K.<br>BATTS, G.W.<br>BROWN, S.C.<br>Natural Environment Applications for NASP/X-30 Design and Mission Planning. For presentation at the 31st AIAA Aerospace Sciences Meeting, Reno, NV, January 11-15, 1993.   | ES44          | JUNG, Y.-D.<br>A Simple Correction for the Born Approximation for Electron Impact Excitation of Hydrogenic Ions. For publication in The Astrophysical Journal, Tucson, AZ.   | ES65             |
| JOHNSON, D.L.<br>EHRENBERGER, J.<br>NASP Natural Environment Support and Atmospheric Modeling—Status. For presentation at NASP, Mid-Term Technology Review, Monterey, CA, April 21-24, 1992.  | ES44          | JUNG, Y.-D.<br>GOULD, R.J.<br>L-Shell X-Ray Opacity of Many-Electron Atoms. For publication in The Astrophysical Journal, Tucson, AZ.  | ES65             |
| JOHNSON, R.B.<br>FENG, C.<br>ETHRIDGE, E.C.<br>Reluctant Glass Formers and Their Applications in Lens Design. For publication in the Proceedings of SPIE's 36th Annual Symposium, Bellingham, WA.   | (UAH)<br>ES75 | JUNG, Y.-D.<br>Semi-Classical Approximation for Electron Impact Excitation of Hydrogenic Ions. For publication in The Astrophysical Journal, Tucson, AZ.   | ES65             |
| JOHNSON, Y.B.<br>MCDALL, K.E.<br>Nickel Hydrogen Battery Expert Systems. For presentation at the Intersociety Energy Conversion Engineering Conference, San Diego, CA, August 3-7, 1992.  | EB12          | JUNG, Y.-D.<br>Electron-Impact Excitation of Hydrogenic Ions in Dense Plasmas. For publication at the 10th International Colloquium on UV and X-Ray Spectroscopy of Astrophysical and Laboratory Plasmas, Berkely, CA, February 3-5, 1992. | ES65             |
| JONES, C.S.<br>Assessment of Intelligent Processing Equipment in NASA. For presentation at the IPE Con-   | EH01          | JUSTUS, C.G. (Georgia Institute of Technology)<br>JAMES, B.F.<br>Mars Global Reference Atmosphere Model (MARS-GRAM). For presentation at MSATT: Mars Surface and Atmosphere Through Time Workshop, Kona, HI, June 29-July 1, 1992.         | ES44             |
|   |               | KAHL, M.S.<br>STOKES, J.<br>Operability of Space Station <i>Freedom's</i> Meteoroid/Debris Protection System. For presentation at the AIAA Space Programs and Technologies Conference, Huntsville, AL, March 24-27, 1992.                  | (Boeing)<br>EJ14 |
|   |               | KAMENETZKY, R.R.<br>WHITAKER, A.F.   | EH12             |

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Performance of Thermal Control Tapes in the Protection of Composite Materials. For presentation at the LDEF Materials Workshop '91, Hampton, VA, November 19-22, 1991.

KELLER, V. PS02  
BERANEK, R.  
HERRMANN, M.  
KOCZOR, R.

Mission to Planet Earth's Geostationary Earth Observatories (GEO). For presentation at The World Space Congress, IAR, Symposium on Earth Observations, Washington, DC, August 28-September 5, 1992.

KELLER, V.W. PS02  
Geostationary Earth Observatory Remote Sensing Instruments. For presentation at the AIAA Space Programs and Technologies Conference, Huntsville, AL, March 24-27, 1992.

KIM, S. (Sverdrup)  
TRINH, H.P. EP55  
Performance Effects Resulting From Plugged Liquid Oxygen Posts of the Space Shuttle Main Engine Injector. For presentation at the 28th AIAA/SAE/ASME/ASEE Joint Propulsion Conference, Nashville, TN, July 6-8, 1992.

KINTNER, P.M. (Cornell University)  
VAGO, J.  
ARNOLDY, R.  
POLLOCK, C. ES53  
MOORE, T.

Localized Regions of Transverse Ion Acceleration by Lower Hybrid Waves. For presentation at the AGU Chapman Conference on Micro- and Meso-Scale Phenomena in Space Plasma, Kauai, HI, February 11-21, 1992.

KNOX, J. ED62  
Impacts of the Space Station *Freedom* Program Restructure on the Atmosphere Revitalization Subsystem of ECLSS. For presentation at the SAE International Conference on Environmental Systems, Seattle, WA, July 8-12, 1992.

KOŁODZIEJCZAK, J.J. ES62  
O'DELL, S.L.  
ELSNER, R.F.  
WEISSKOPF, M.C.  
Evidence for Dust Contamination on the VETA-1 Mirror Surface. For publication and

presentation at the SPIE International Symposium on Optical Applied Science and Engineering, San Diego, CA, July 19-24, 1992.

KOUVELIOTOU, C. ES62  
PACIESAS, W.S. (UAH)  
FISHMAN, G.J. ES62  
MEEGAN, C.A. ES62  
WILSON, R.B. ES62

Gamma-Ray Burst Color-Color Diagrams. For publication in *Astronomy and Astrophysics*, Meudon, France.

KOUVELIOTOU, C. (USRA)  
FINGER, M.H. (Computer Sciences Corp.)  
FISHMAN, G.J. ES62  
MEEGAN, C.A.  
WILSON, R.B.  
PACIESAS, W.S. (UAH)

Circular No. 5576—Quasi-Periodic Oscillations in Soft X-Ray Flux From Cygnus X-1. For publication in *IAU Circular*, Cambridge, MA.

KOUVELIOTOU, C. ES62  
FISHMAN, G.J.  
MEEGAN, C.A.  
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Soft Gamma Repeater (SGR). For publication in *IAU Circular*, Cambridge, MA.

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FINGER, M.H.  
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Quasi-Periodic Oscillations (QPO) Detected in Hard X-Ray Flux of the X-Ray Flux of the X-Ray Transient GRO J0422+32. For publication in *IAU Circular*, Cambridge, MA.

KOUVELIOTOU, C. ES62  
FISHMAN, G.J.  
MEEGAN, C.A.  
WILSON, R.B.  
PACIESAS, W.S.  
BROCK, M.N.

Study of Precursor Activity Related to Gamma-Ray Bursts Observed With the BATSE/GRO

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- Experiment. For presentation at the 179th Meeting of AAS, Atlanta, GA, January 12-16, 1991, and for publication in the proceedings.
- KUSUNOSE, M. ES65  
MINESHIGE, S.  
Geometrically Thin, Hot Accretion Disks: Topology of the Thermal Equilibrium Curves. For publication in The Astrophysical Journal, The University of Chicago Press, Chicago, IL.
- LACKEY, J.D. EP64  
MYERS, W.N.  
Design of a Prototype Advanced Main Combustion Chamber for the Space Shuttle Main Engine. For presentation at the AIAA/SAE/ASME/ASEE 28th Joint Propulsion Conference, Nashville, TN, July 6-8, 1992.
- LAMBING, S.J. EO44  
REYNOLDS, S.J. (Boeing)  
Silvabase: A Flexible Data File Management System. For presentation at Technology 2001, San Jose, CA, December 3-5, 1991.
- LANGER, S. (Sverdrup)  
TYGIELSKI, P. EP64  
Mathematical Model of the Space Shuttle Main Engine Gaseous Oxygen Control Valve. For presentation at the 28th AIAA/SAE/ASME/ASEE Joint Propulsion Conference and Exhibit, Nashville, TN, July 6-8, 1992.
- LAPENTA, C.C. ES44  
The Function of the Earth Observing System Data Information System (EOSDIS) Distributed Active Archive Centers. For presentation at the AIAA Space Programs and Technology Conference, Huntsville, AL, March 26, 1992.
- LAROSA, T.N. ES52  
MOORE, R.L.  
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- LEE, T.J. DA01  
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JOY, M.  
SULKANEN, M.  
LUGINBUHL, C. (USNO)  
NEWBERRY, M. (Steward O.)  
Near Infrared Imaging of X-Ray Selected  
Cooling Flows. For presentation at the 179th  
Meeting of the American Astronomical Society,  
Atlanta, GA, January 13–16, 1992.

PRINCE, A. PP03  
HAMAKER, J.  
Comparison Economics of Future. For  
presentation at the World Space Congress,  
Washington, DC, August 28–September 5, 1992.

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HAMAKER, J.  
National Launch System (NLS) Comparative  
Economic Analysis. For presentation at the  
AIAA Space Programs and Technology Con-  
ference, Huntsville, AL, March 24–27, 1992.

RABIN, D. ES52  
DOWDY, J.F., JR.  
Pervasive Variability in the Quiet Solar  
Transition Region. For publication in the  
Astrophysical Journal, Chicago, IL.

RAIKAR, G.N. (UAH)  
GREGORY, J.C.  
CHRISTL, L.C.  
PETERS, P.N. ES63  
Interaction of Atomic Oxygen With Thin Film  
and Bulk Cooper: An XPS, AES, XRD, and  
Profilometer Study. For presentation at the  
Second LDEF Symposium, San Diego, CA, June  
1–5, 1992.

RAKOCZY, J.M. ED12  
BUTLER, M.L.  
CHRISTIAN, P.M.  
TOBBE, P.A.  
A Program for the Investigation of Multibody  
Modeling, Verification, and Control. For pre-  
sentation at the NASA/NSF/DoD Workshop on  
Aerospace Computational Control, Santa  
Barbara, CA, August 17–19, 1992.

RAMACHANDRAN, N. ES74  
JONES, J.  
CURRERI, P.  
DOWNEY, J.

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Materials Processing in a Centrifuge—Numerical Modeling of Macro-gravity Effects. For presentation at the AIAA 30th Aerospace Sciences Meeting, Reno, NV, January 6–9, 1992.

RAMACHANDRAN, N. (USRA)  
SMITH, A. ED35  
HEAMAN, J.

An Experimental Study of the Fluid Mechanics Associated With Porous Walls. For presentation at the AIAA 30th Aerospace Sciences Meeting, Reno, NV, January 6–9, 1992.

RAMIREZ, J.A. ES42  
CHOU, S.-H.

Impact of Complex Land Surface Hydrology on the Development and Evolution of Mid-Latitude Synoptic Waves: Sensitivity Experiments. For presentation at the Conference on Hydroclimatology, Anaheim, CA, January 17–23, 1993.

RAMSEY, B.D. ES65  
The Microstrip Proportional Counter. For presentation at SPIE's EUV, X-Ray, and Gamma-Ray Instrumentation for Astronomy III, San Diego, CA, July 19–24, 1992.

RAO, S.M. (Alabama A&M University)  
LOO, B.H. (UAH)  
METZER, R.M. (UA)  
SHIELDS, A.S. ES74  
PENN, G.B.  
FRAZIER, D.O.

New Polymorph of 2-Methyl-4-Nitroaniline—An Efficient Nonlinear Optical Material. For publication in the Journal of Applied Physics, Argonne, IL.

REDMON, J.W., JR. ED54  
Novel Aerospace Mechanisms: A Passive Tether Damping Device for Tethered Satellite; And a Pin/Latch Structural Interface System. For presentation at the Aerospace Mechanisms Symposium, Greenbelt, MD, May 13, 1992.

RHODES, P. ES71  
SNYDER, R.S.  
ROBERTS, G.O.  
BAYGENTS, J.C.  
Electrohydrodynamic Effects in Continuous Flow Electrophoresis. For publication in the Applied and Theoretical Electrophoresis Journal, Hampshire, England, October 1991.

RICHARDS, J.S. HA31  
National Launch System Advanced Development: Propulsion. For presentation at the 1992 AIAA Space Programs and Technologies Conference and Exhibit, Huntsville, AL, March 24–27, 1992.

RINCON, C. (University of Texas)  
NUNES, A.C., JR. EH42  
MCCLURE, J. C.  
ARROWOOD, R.

Geometric Effects on Strength of Butt Welds in 2219-T87 Aluminum. For presentation at the Third International Conference on Trends in Welding Research, Gatlinburg, TN, June 1–4, 1992.

ROBERTS, F.E., III EH34  
Control System Application of a Diamond Nucleation and Growth Model to Diamond Torch Film Deposition. For presentation at the 23rd Annual Pittsburgh Conference on Modeling and Simulation, Pittsburgh, PA, April 30–May 1, 1992.

ROBERTSON, F. ES42  
BARRON, E.  
GOODMAN, S.  
FITZJARRALD, D.  
CHRISTY, J.  
THOMPSON, S.

The Global Hydrologic Cycle as Simulated by the GENESIS Climate Model: Intercomparisons With Multiple Climate Data Bases. For presentation at the American Meteorological Society Annual Meeting, Anaheim, CA, January 17–22, 1993.

ROBINSON, J.H. ED52  
MOG, R.A. (Science Applications International)  
Preliminary Design of a Meteoroid/Orbital Debris Shield System for a Mars Mission Spacecraft. For presentation at the AIAA Space Programs and Technologies Conference, Huntsville, AL, March 24–27, 1992.

ROBINSON, J.H. ED52  
The Effectiveness of Multi-layer Insulation as Meteoroid and Orbital Debris Shielding. For presentation at the AIAA Space Programs and Technologies Conference, Huntsville, AL, March 24–27, 1992.

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| <p>RODGERS, E.B. EH32<br/>SMITHERS, G.A.<br/>OBENHUGER, D.C.<br/>HUFF, T.L.<br/>Aquatic Biofilms and Their Responses to Disinfection and Invading Species. For presentation at the International Conference on Environmental Systems, Seattle, WA, July 1992.</p> <p>ROLIN, T.D. ES75<br/>KAUKLER, W.F.<br/>ANDERSON, E.E.<br/>ETHRIDGE, E.<br/>Glass Formation in the Bi-Sr-CA-Cu-O System. For presentation at the Indianapolis Meeting of the American Physical Society, Indianapolis, IN, March 16-20, 1992.</p> <p>RUSSELL, S.S. EH13<br/>MCNEILL, S.R.<br/>Strain Field Measurement With PC-Based Digital Image Correlation. For presentation at Technology 2002, Baltimore, MD, December 1-3, 1992.</p> <p>RUSSELL, S.S. EH13<br/>Determination of High Temperature Strains Using a PC Based Vision System. For presentation at 1992 Focus: Measurement Technology for Aerospace Application in High-Temperature, NASA/LRC, Hampton, VA, April 22-23, 1992.</p> <p>SAFIE, F.M. CT13<br/>Use of Probabilistic Design Methods for NASA Applications. For presentation at the ASME WAM '92 Symposium on Reliability Technology, Anaheim, CA, November 8-13, 1992.</p> <p>SAKURAI, H. ES65<br/>RAMSEY, B.D.<br/>The Energy Resolution of a High-Pressure Xenon-Filled Proportional Counter. For presentation at the 1991 IEEE Nuclear Science Symposium, Santa Fe, NM, November 5-8, 1991.</p> <p>SAMBAMURTHI, J. ED33<br/>TAYLOR, J.<br/>Plume Particle Collection and Analyses in Scaled ASRM MNASA Motor Test. For presentation at the Fine Particle Symposium, Las Vegas, NV, July 13-17, 1992.</p> | <p>SANDER, E.J. (Martin Marietta)<br/>GOSDEIN, D.R. EE21<br/>Engine Systems Analysis Results of the Space Shuttle Main Engine Redesigned Powerhead Initial Engine Level Testing. For presentation at the 28th AIAA/SAE/ASME/ASEE Joint Propulsion Conference, Nashville, TN, July 1992.</p> <p>SANDERS, J.H. (IIT Research)<br/>PANDA, B.<br/>BHAT, B. EH23<br/>MATSON, D.M. (Aerojet)<br/>The Influence of Chromium Content on the High-Temperature Oxidation Behavior of Fe-Ni Based Superalloys in Air. For presentation at the Seventh International Symposium on Superalloys, Seven Springs Mt. Resort, Champion, PA, September 20-24, 1992.</p> <p>SCHMIDT, G.R. EP53<br/>CHUNG, T.J. (UAH)<br/>Combined Thermocapillary/Buoyancy-Driven Flow About a Curvilinear Evaporating Meniscus. For presentation at the 27th AIAA Thermophysics Conference, Nashville, TN, July 6-8, 1992.</p> <p>SCHMIDT, G.R. EP53<br/>CARRIGAN, R.W.<br/>HAHS, J.E.<br/>VAUGHAN, D.A. (Martin Marietta)<br/>FOUST, D.C.<br/>No-Vent Fill Pressurization Tests Using a Cryogen Simulant. For presentation at the 28th AIAA/SAE/ASME/ASEE Joint Propulsion Conference, Nashville, TN, July 6-8, 1992.</p> <p>SHELTON, B.W. PD21<br/>MURPHY, T.<br/>The Saturn V F-1 Engine Revisited. For presentation at the AIAA Space Programs and Technologies Conference, Huntsville, AL, March 24-27, 1992.</p> <p>SINHA, S.C. (Auburn) ED12<br/>BENNER, J.W.<br/>WIENS, G.J.<br/>Experimental Verification of Component Mode Modeling of a Flexible Multibody System. For presentation at the ASME Winter Annual Meeting, Anaheim, CA, November 8-13, 1992.</p> |
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| <p>SMELSER, J.W. HA31<br/>NLS Propulsion—Government View. For presentation at the SAE for 28th Joint Propulsion Conference, Nashville, TN, July 6–9, 1992.</p> <p>SMITH, M. (New Technology)<br/>LAFONTAINE, C.V.<br/>LAFONTAINE, F.J.<br/>MOSS, D.<br/>GOODMAN, B.M.<br/>DENGEL, R.C.<br/>YOUNG, J.T.<br/>GOODMAN, H.M. ES44<br/>Wetnet: A Status Report. For presentation at the AMS Conference on Interactive Information and Processing Systems for Meteorology, Oceanography, and Hydrology, Atlanta, GA, January 15, 1992.</p> <p>SOHN, B.-J. (USRA)<br/>ROBERTSON, F.R. ES42<br/>Intercomparison of Observed Cloud Radiative Forcing: A Zonal and Global Perspective. For publication in the Bulletin of American Meteorological Society, Boston, MA.</p> <p>SOHN, B.-J. ES42<br/>ROBERTSON, F.R.<br/>SRIKISHEN, J.<br/>Intercomparison of Observed Cloud-Radiative Forcing. For presentation at the International Radiation Symposium, Tullinn, Estonia, August 3–8, 1992.</p> <p>SPENCER, R.W. ES43<br/>Principal Scientific Uncertainties Related to Global Climate Change. For presentation at the Pittsburgh Coal Conference, Pittsburgh, PA, October 12–16, 1992.</p> <p>SRINIVAS, R. (Teledyne Brown)<br/>SCHAEFER, D.A. JA83<br/>Crystal Growth Furnace: An Overview of the System Configuration and Planned Experiments on the First United States Microgravity Laboratory Mission. For presentation at the AIAA 30th Aerospace Sciences Meeting, Reno, NV, January 6–9, 1992.</p> <p>SRINIVASAN, R. (Alabama A&amp;M University)<br/>HYDE, H.W. ES74<br/>PENN, B.<br/>FRAZIER, D.O.<br/>ET AL.</p> | <p>Second and Third Harmonic Generation by Reflection From Langmuir-Blodgett Film of New Organic Material: N-Alkyl and N, N-Dialkyl Derivatives of 4-Methyl-6-Nitro-2-Quinolinamines With Sec-Butyl as Substituent. For presentation and IQEC '92, Vienna, Austria, June 14–19, 1992.</p> <p>SRIVASTAVA, V.<br/>JARZEMBSKI, M. ES43<br/>BOWDLE, D.A.<br/>Comparison of Calculated Aerosol Backscatter at 9.1 <math>\mu\text{m}</math> and 2.1 <math>\mu\text{m}</math> Wavelengths. For publication in Applied Optics, Washington, DC.</p> <p>STEINCAMP, J.W. PD31<br/>LEE, R. (Martin-Marietta)<br/>Reliability Analysis Techniques for Engine-Out Failure in Main Propulsion Systems. For presentation at the AIAA Space Programs and Technologies Conference, Huntsville, AL, March 24–27, 1992.</p> <p>STOKES, J.W. EJ14<br/>WILLIAMS, K.A.<br/>Crew Considerations in the Design for Space Station <i>Freedom</i> Modules On-Orbit Modules. For presentation at the AIAA Space Programs and Technologies Conference, Huntsville, AL, March 24–27, 1992.</p> <p>STONE, N.H. ES53<br/>An Early Assessment of the TSS-1 Mission. For presentation at the American Geophysical Union Fall Meeting, San Francisco, CA, December 7–11, 1992.</p> <p>SU, C.-H. ES75<br/>VOLZ, M.P.<br/>GILLIES, D.C.<br/>SZOFRAN, F.R.<br/>LEHOCZKY, S.L.<br/>Growth of <math>\text{ZnTe}</math> by Physical Vapor Transport and Traveling Heater Method. For presentation at the 10th International Conference on Crystal Growth, San Diego, CA, August 16–21, 1992.</p> <p>SUDDUTH, R.D. (Boeing)<br/>WERP, R.<br/>CARRUTH, R., JR. EH12<br/>VAUGHN, J.<br/>HOLT, J.M.<br/>Plasma Effects on the Passive External Thermal Control Coating of Space Station <i>Freedom</i>. For</p> |
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presentation at the AIAA Space Programs and Technologies Conference, Huntsville, AL, March 26, 1992.

- SUESS, S.T. ES52  
NERNEY, S. (NRC-NAS)  
Cosmic Ray Access to the Heliosphere. For presentation at the 1992 Fall AGU Meeting, San Francisco, CA, December 7-11, 1992.
- SUESS, S.T. ES52  
Temporal Variations in the Termination Shock Distance. For publication in the Journal of Geophysical Research, Washington, DC, June 1992.
- SUESS, S.T. ES52  
MCCOMAS, D.J.  
HOEKSEMA, J.T.  
Projection of Heliospheric Current Sheet Tilt: 1992-1996. For publication in the Journal of Geophysical Research Letters, Washington, DC.
- SUESS, S.T. ES52  
The Relationship Between Coronal and Interplanetary Magnetic Fields. For presentation at COSPAR, World Space Congress, Washington, DC, August 28-September 5, 1992.
- SULKANEN, M.E. ES65  
WANG, J.C.L. (CITA)  
LOVELACE, R.V.E. (Cornell University)  
Intrinsically Asymmetric Astrophysical Jets. For presentation at the 179th Meeting of the American Astronomical Society, Atlanta, GA, January 13-16, 1992.
- SULLIVAN, R.M. ED24  
A Coupled Solution Method for Predicting the Thermostructural Response of Decomposing, Expanding Polymeric Composites. For publication in the Journal of Composite Materials, USA.
- SULLIVAN, R.M. ED24  
A Coupled Solution Method for Predicting the Thermostructural Response of Decomposing, Expanding Polymeric Composites. For presentation at the ASME Summer Mechanics Meeting and Materials, Scottsdale, AZ, April 28-May 1, 1992.
- SULLIVAN, R.M. ED24  
SALAMON, N.J.

A Finite Element Method for the Thermochemical Decomposition of Polymeric Materials—Part I: Theory. For publication in the International Journal of Engineering Science, London, England.

- SULLIVAN, R.M. ED24  
SALAMON, N.J.  
A Finite Element Method for the Thermochemical Decomposition of Polymeric Materials—Part II: Carbon Phenolic Composites. For publication in the International Journal of Engineering Science, London, England.
- SUMRALL, J.P. PT41  
HUBER, W.G.  
PRIEST, C.  
Space Transportation Implementations for the Space Exploration Initiative. For presentation to The World Space Congress, Washington, DC, August 28-September 5, 1992.
- SUSKO, M. ES44  
Comparison of FPS-16 Radar/Jimsphere and NASA's 50-mHz Radar Wind Profiler Turbulence Indicators. For presentation at the AIAA 31st Aerospace Science Meeting and Exhibit, Reno, NV, January 11-14, 1993.
- TELESCO, C.M. ES63  
GEZARI, D.Y.  
High-Resolution 12.4  $\mu\text{m}$  Images of the Starburst Region in M82. For publication in the Astrophysical Journal Letters, Cambridge, MA.
- THOMAS, L.D. EJ13  
Functional Implications of Component Commonality in Operational Systems. For publication in the IEEE Transactions on Systems, Man, and Cybernetics, New York, NY.
- TINKER, M.L. ED22  
ADMIRE, J.R.  
IVEY, E.W.  
Residual Flexibility Test Method for Verification of Constrained Structural Models. For presentation at the AIAA 33rd Structures, Structural Dynamics, and Materials Conference, Dallas, TX, April 13-15, 1992.
- TINKER, M.L. ED22  
ADMIRE, J.R.  
IVEY, E.

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- Mass-Additive Modal Test Method for Verification of Constrained Structural Models. For presentation at the 10th International Modal Analysis Conference, San Diego, CA, February 3-7, 1992.
- TORR, M.R. ES51  
The ATLAS-1 Mission. For presentation at the 29th COSPAR Meeting, Washington, DC, August 30-September 5, 1992.
- TORR, M.R. ES51  
TORR, D.G. (UAH)  
CHANG, T.  
RICHARDS, P.G.  
BALDRIDGE, T.W. ES51  
OWENS, J.K.  
DOUGANI, H. (UAH)  
ET AL.  
The First Negative Bands of  $N_2^+$  in the Dayglow From the ATLAS-1 Shuttle Mission. For publication in the Geophysical Research Letters, Washington, DC.
- TORR, M.R. ES51  
TORR, D.G. (UAH)  
RICHARDS, P.G.  
 $N(^2P)$  in the Dayglow: Measurement and Theory. For publication in the Geophysical Research Letters, Washington, DC.
- TORR, M.R. ES51  
The Scientific Objectives of the ATLAS-1 Shuttle Mission. For publication in the Geophysical Research Letters, Washington, DC.
- TORR, M.R. ES51  
TORR, D.G. (UAH)  
 $N(^2P)$  in the Dayglow: Measurement and Theory. For presentation at the 1992 Fall AGU Meeting, San Francisco, CA, December 7-11, 1992.
- TORR, M.R. ES51  
Studies of the Stratosphere, Mesosphere, Thermosphere, and Ionosphere from the ATLAS-1 Shuttle Mission. For presentation at the 1992 Fall Meeting of AGU, San Francisco, CA, December 7-11, 1992.
- TORR, M.R. ES51  
TORR, D.G.  
RICHARDS, P.G.
- HLADKY, K.J.  
Global Modeling of the Thermospheric  $N_2^+$  First Negative Emissions and Comparison With Measurements From the Space Shuttle. For presentation at the 1992 Spring AGU Meeting, Montreal, Canada, May 12-15, 1992.
- TORR, M.R. ES51  
Early Results From the ATLAS-1 Shuttle Mission of Relevance to STEP. For presentation at the 1991 STEP Symposium, COSPAR Colloquium No. 5, Laurel, MD, August 24-28, 1992.
- TORR, M.R. ES51  
SULLIVAN, K.  
The Atmospheric Laboratory for Applications and Science-1: A Shuttle Mission. For publication in EOS, Washington, DC.
- TUCKER, P.K. ED32  
CROTEAU-GILLESPIE, M.  
Combustion Devices Technology Team: An Overview and Status of STME-Related Activities. For presentation at the 28th AIAA/SAE/ASME/ASEE Joint Propulsion Conference, Nashville, TN, July 6-8, 1992.
- TYGIELSKI, K.S. EP62  
Advanced Technology Application for Combustion Chamber Concepts. For presentation at the AIAA/SAE/ASME/ASEE 28th Joint Propulsion Conference, Nashville, TN, July 6-8, 1992.
- UPADHYAY, T. (Mayflower Communications)  
COTTERILL, S. (Mayflower Communications)  
DEATON, A.W. EL58  
Autonomous Reconfigurable GPS/INS Navigation and Pointing System for Rendezvous and Docking. For presentation at the AIAA Space Programs and Technologies Conference, Huntsville, AL, March 24-27, 1992.
- VARNAVAS, K. EB32  
WEDDENDORF, B.  
Wheelchair Stair Lift. For publication in Design News, Newton, MA.
- VAUGHN, J.A. EH12  
CARRUTH, M.R., JR.  
Extrapolation of Electrical Breakdown Currents From the Laboratory to Space Station. For publication in the Journal of Spacecraft and Rockets, Washington, DC.

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| VESSOT, R.F.C.  | (Smithsonian) | SUESS, S.T.  |      |
| MATTISON, E.M.  |               | POLETTA, G.  |      |
| NYSTROM, G.U.   |               | A Two-Dimensional MHD Global Coronal Model: Steady-State Streamers. For publication in the Proceedings of the Solar Wind Seven, Goslar, Germany.   |      |
| DECHER, R.  | ES61          |  |      |
| Test of an Orbiting Hydrogen Maser Clock System Using Laser Time Transfer. For publication in the Proceedings of the 23rd Annual Precise Time and Time Interval (PTTI) Applications and Planning Meeting, Pasadena, CA, December 3-5, 1991. |               |  |      |
| VLASSE, M.  | ES74          | WANG, J.C.L.   | ES65 |
| GOLBEN, J.  |               | SULKANEN, M.E.   |      |
| DECHER, R.  |               | LOVELACE, R.V.E.   |      |
| Process Optimization for 123 and Bi-Based Superconductors. For presentation at the Third International Conference and Exhibit, World Congress on Superconductivity, Munich, Germany, September 14-18, 1992.                                 |               | Intrinsically Asymmetric Astrophysical Jets. For publication in The Astrophysical Journal, Chicago, IL.  |      |
| VLASSE, M.  | ES74          | WANG, T.S.   | ED32 |
| GOLBEN, J.  |               | LUONG, V.  |      |
| MITCHELL, T.  |               | Numerical Analysis of the Hot-Gas-Side and Coolant-Side Heat Transfer in Liquid Rocket Engine Combustors. For presentation at the 28th AIAA/SAE/ASME/ASEE Joint Propulsion Conference, Nashville, TN, July 6-8, 1992.                            |      |
| Process Optimization for the Pb and Sb-Substituted Bi-Based 2:2:2:3 Bulk Ceramic Superconductors. For publication in Superconductor Science and Technology, Bristol, United Kingdom.  |               | WANG, T.S.   | ED32 |
| WALKER, A.B.C., JR.   | ES52          | CHYU, M.K.   |      |
| HOOVER, R.B.  |               | Effects of Turning Configuration on Flow and Heat Transfer in Blade Internal Cooling Passage. For presentation at the Fourth International Symposium on Transport Phenomena of Rotating Machinery, Honolulu, HI, April 5-8, 1992.                |      |
| The Multi-Spectral Solar Telescope Array (MSSTA II). For presentation at SPIE's 1992 International Symposium on Optical Applied Science and Engineering, San Diego, CA, July 19-24, 1992.   |               | WATWOOD, M.  | EH23 |
| WALKER, S.T.  | PD22          | BOND, R.   |      |
| Thermal Design of a Large Lunar Telescope. For presentation at the Third International Conference on Engineering, Construction, and Operations in Space, Denver, CO, May 31-June 4, 1992.   |               | VESELY, E.J., JR.  |      |
| WANG, A.-H.   | (UAH)         | The Effect of Machining Techniques, Notch Design, and Strain Rates on the Notched Tensile Strength of Inconel 718 in High Pressure Hydrogen. For presentation at Hydrogen Effects on Materials in Propulsion Systems, MSFC, AL, May 20-21, 1992. |      |
| WU, S.T.  |               | WEGRICH, R.D.  | ED61 |
| SUESS, S.T.   | ES52          | Space Station <i>Freedom</i> Thermal Control and Life Support System Design. For presentation at the World Space Congress, IAF, Washington, DC, August 28-September 5, 1992.   |      |
| POLETTA, G.   |               | WEISSKOPF, M.C.  | ES65 |
| A Two-Dimensional MHD Global Coronal Model: Steady-State Streamers. For publication in Solar Physics, The Netherlands.  |               | The AXAF Veta Test—An Overview. For presentation at the Multilayer and Grazing Incidence X-Ray/EUV Optics for Astronomy and Projection Lithography, San Diego, CA, July 19-24, 1992.   |      |
| WANG, A.H.  | ES52          |  |      |
| WU, S.T.  |               |  |      |

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| <p>WEISSKOPF, M.C. TA01<br/>HUMPHREYS, J.T.<br/>BILBRO, J.W.<br/>VAN SPEYBROECK, L.<br/>AXAF Passes Resolution Test. For presentation at the World Space Congress, Washington, DC, August 28–September 5, 1992.</p> <p>WEST, E.A. ES52<br/>Crosstalk in Solar Polarization Measurements. For presentation at SPIE's International Symposium on Optical Applied Science and Engineering, San Diego, CA, July 19–24, 1992.</p> <p>WEST, E. ES52<br/>WILKINS, N. (UAH)<br/>DC Bias Modulation Characteristics of Longitudinal KD*P Modulators. For presentation at SPIE's 1992 International Symposium on Optical Applied Science and Engineering, San Diego, CA, July 19–24, 1992.</p> <p>WEST, M.E. ED12<br/>RAKOCZY, J.M.<br/>Magnitude Calibration of a Fixed Head Star Tracker Using Astro-1 Flight Data. For presentation at the AIAA Space Programs and Technology Conference, Huntsville, AL, March 24–27, 1992.</p> <p>WESTRA, D.G. ED63<br/>Vapor Compression Cycles for Life-Support Equipment in Space. For presentation at the International Conference on Life Support and Biospherics, Huntsville, AL, February 18–20, 1992.</p> <p>WHITAKER, A.F. EH11<br/>KAMENETZKY, R.R.<br/>FINCKENOR, M.M.<br/>NORWOOD, J.K.<br/>Atomic Oxygen Effects on LDEF Experiment A0171. For presentation at the Second LDEF Postretrieval Symposium, San Diego, CA, June 1–5, 1992.</p> <p>WHITAKER, A.F. EH11<br/>FINCKENOR, M.<br/>KAMENETZKY, R.<br/>Property Changes Induced by the Space Environment in Polymeric Materials on LDEF. For presentation at the AIAA 30th Aerospace Science Meeting, Reno, NV, January 6–9, 1992.</p> | <p>WIENS, G.J. (Auburn University) ED12<br/>TSAI, H.<br/>Dynamic Characteristics From a Planar Two-Link Flexible Multibody System Including the Gravity Effects. For presentation at the ASME 1992 Mechanisms Conference, Phoenix, AZ, September 13–16, 1992.</p> <p>WILHELM, J.M. ED24<br/>International Space University (ISU) 1991 Design Project: International Mars Mission. For presentation at the Society of Women Engineers, 1992 Conference, Orlando, FL, June 22–28, 1992.</p> <p>WILKINSON, L.K. ES52<br/>EMSLIE, A.G.<br/>GARY, G.A.<br/>On Neutralized Currents in the Solar Corona. For publication in the Astrophysical Journal, Chicago, IL.</p> <p>WILLIAMSEN, J.E. ED52<br/>JOLLEY, W.H.<br/>Statistical Ballistic Limit Curve Regression for Space Station <i>Freedom</i> Meteoroid/Orbital Debris Shielding. For presentation at the 1992 Hypervelocity Impact Symposium, Austin, TX, November 17–20, 1992.</p> <p>WILLIAMSEN, J.E. ED52<br/>JOLLEY, W.H.<br/>Ballistic Limit Curve Regression for Space Station <i>Freedom</i> Orbital Debris Shields. For presentation at the AIAA Space Programs Conference, Huntsville, AL, March 24, 1992.</p> <p>WILLAMSEN, J.E. ED52<br/>Orbital Debris Risk Analysis and Survivability Enhancement for <i>Freedom</i> Station Manned Modules. For presentation at the AIAA Space Programs Conference, Huntsville, AL, March 24, 1992.</p> <p>WILLIAMSEN, J.E. ED52<br/>HOOMANI, J.C.<br/>MOG, R.A.<br/>A Dynamic Stochastic Simulation of Space Debris/Meteoroid Impacts for Space Station <i>Freedom</i>. For presentation at the AIAA Space Programs Conference, Huntsville, AL, March 24, 1992.</p> |
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| WILSON, G.S.   | ES41   | Flaring Rate, Energetic Event Rate, and the Solar Cycle. For publication in the Journal of Geophysical Research, Washington, DC. |
| HUNTRESS, W.T.   |        |  |
| Mission to Planet Earth (MTPE). For presentation at the 42nd Congress of the International Astronautical Federation (IAF), Montreal, Canada, October 6–10, 1991.   |        |  |
| WILSON, R.B.   | ES62   |  |
| FINGER, M.H.   |        |  |
| FISHMAN, G.J.  |        |  |
| MEEGAN, C.A.   |        |  |
| PACIESAS, W.S.   |        |  |
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| HARMON, B.A.   |        |  |
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| MEEGAN, C.A.   |        |  |
| FINGER, M.H.   |        |  |
| PACIESAS, W.S.   |        |  |
| PRINCE, J.A.   |        |  |
| GRUNSFELD, J.M.  |        |  |
| CHAKRABARTY, D.  |        |  |
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| WILSON, R.B.   | ES62   |  |
| BATSE/CGRO Observations of Isolated Pulsar(s). For presentation at the Los Alamos National Laboratory's Workshop on Isolated Pulsar(s), Taos, NM, February 23–28, 1992.  |        |  |
| WILSON, R.B.   | ES62   |  |
| BATSE Observations of Isolated Pulsars and Disk-Fed X-Ray Binaries. For presentation at the Compton Observatory Symposium, St. Louis, MO, October 15–17, 1992.   |        |  |
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| PACIESAS, W.S.   | (UAH)  |  |
| BATSE Pulsed Source Observations—Preliminary Results. For presentation at the 179th AAS Meeting, Atlanta, GA, January 13–16, 1992.   |        |  |
| WILSON, R.M.   | ES52   |  |
| On the Variation of the Sun's X-Ray Background Flux and Its Relations to the Sun's   |        |  |
| WILSON, R.M.   | ES52   |  |
| A Prediction for the Onset of Cycle 23. For publication in the Journal of Geophysical Research, Washington, DC.  |        |  |
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| On the Variation of the Nimbus-7 Total Solar Irradiance. For publication in Solar Physics, The Netherlands.  |        |  |
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| An Early Estimate for the Size of Cycle 23. For publication in Solar Physics, The Netherlands.   |        |  |
| WORKMAN, G.  | (UAH)  |  |
| WANG, M.   |        |  |
| BRYSON, C.C.   | EH13   |  |
| COOK, M.B.   |        |  |
| The Effect of Surface Features on Bototic Eddy Current Inspection of Graphite Fiber Components. For presentation at the ASNT 1992 Spring Conference, Orlando, FL, March 30–April 3, 1992.                                |        |  |
| WORLUND, A.L.  | EE81   |  |
| MONK, J.C.   |        |  |
| BACHTEL, F.D.  |        |  |
| NLS Propulsion Design Considerations. For presentation at AIAA, Irvine, CA, February 3–5, 1992.  |        |  |
| WORLUND, A.L.  | EE81   |  |
| NLS Vehicle Design Features. For presentation at AIAA, Huntsville, AL, March 24–27, 1992.  |        |  |
| WRIGHT, M.   | CN22   |  |
| Space Exploration and Human Imagination: The Collaborative Efforts of Wernher von Braun and Walt Disney. For presentation at the 1993 Southern Humanities Council Conference, UAH, Huntsville, AL, February 12–14, 1993. |        |  |
| WRIGHT, M.   | CN22   |  |
| Slide Presentation Highlighting History of Rocketry, NASA, MSFC. For Presentation at Project LASER, a presentation at various schools and civic groups.  |        |  |
| WRIGHT, P.D.   | (USRA) |  |
| GOODMAN, S.J.  | ES44   |  |

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- A Multiparameter Radar Examination of a Mesoscale Convective System. For presentation at the 25th International Conference on Radar Meteorology, Paris, France, June 24–28, 1991.
- WU, K. ES65  
WICKRAMASINGHE, D.T.  
Cyclotron Emission From Ridge-Like Emission Regions in AM Herculis Binaries. For publication in Astronomical Society of the Pacific, San Francisco, CA.
- WU, K. ES65  
WICKRAMASINGHE, D.T.  
Three-Dimensional Structured Shocks in AM Herculis-Type Systems—II. Cyclotron Emission From Ridge-Shape Emission Regions. For publication in Monthly Notices of Royal Astronomical Society, Edinburgh, Scotland, UK.
- WU, K. ES65  
CHANMUGAM, G.  
Effects of Magnetic Fields on QPO Properties in AM Herculis Binaries. For publication in Astronomical Society of the Pacific, San Francisco, CA.
- WU, K. ES65  
WICKRAMASINGHE, D.T.  
Accretion Onto AM Herculis Binaries With a Multipole Magnetic Field. For publication in Astronomical Society of the Pacific, San Francisco, CA.
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WICKRAMASINGHE, D.T.  
The Magnetic Field Configurations of AM Herculis Binaries. For publication in Monthly Notices of Royal Astronomical Society in Press, United Kingdom.
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A Study on the Period Distribution of Magnetic Cataclysmic Variables. For publication in the Proceedings of Astronomical Society of Australia, Australia.
- WU, K. ES65  
CHANMUGAM, G.  
SHAVIV, G.
- Properties of QPO's in Accreting Magnetic White Dwarfs. For publication in Astrophysical Journal, Chicago, IL.
- YANG, H.Q. (CFD)  
PRZEKWAS, A.J.  
NUNES, A.C., JR. EH42  
A Mathematical Model for Weld Undercutting Caused by Oxygen Contamination. For publication in Welding Journal, Miami, FL.
- YOUNG, A.C. PD32  
MULQUEEN, J.A.  
EMRICH, W.J.  
Mars Transportation System Synthesis. For presentation at the 29th Space Congress, Cocoa Beach, FL, April 21–24, 1992.
- ZHANG, X. (UAH) ES53  
COMFORT, R.H.  
MUSIELAK, Z.  
MOORE, T.E. ES53  
GALLAGHER, D.L.  
GREEN, J.L. (GSFC)  
Propagation Characteristics of Pc3 Compressional Waves Generated at the Dayside Magnetopause. For publication in Journal of Geophysical Research, Washington, DC.
- ZHAO, J.-H. (University of New Mexico)  
BURNS, J.O.  
NORMAN, M.L.  
SULKANEN, M.E. ES65  
Instabilities in Astrophysical Jets: II. Numerical Simulations of Slab Jets. For publication in Astrophysical Journal, Chicago, IL.
- ZIMMERMAN, F. EH42  
MCKECHNIE, T.N. (Rockwell)  
POORMAN, R. EH42  
LIAW, Y. (Rockwell)  
Metallurgy and Properties of Plasma Spray-Formed Materials. For presentation at ASM International's National Thermal Spray Conference, Orlando, FL, June 1, 1992.
- ZIMMERMAN, F.R. EH42  
BRYANT, M.A.  
MCKECHNIE, T.N. (Rockwell)  
Vacuum Plasma Spray Applications on Liquid Fuel Rocket Engines. For presentation at the SAE Joint Propulsion Conference, Nashville, TN, July 6–9, 1992.

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ZISSA, D.E.	EB23	ZWIENER, J.M.	EH15
Comparison of Ring Focus Image Profile With Predictions for the AXAF VETA-I Test. For presentation at the SPIE 1992 International Symposium, San Diego, CA, July 19-24, 1992.		MELL, R.J.	
		PETERS, P.N.	
		WILKES, D.R.	(Arizona Tech)
		MILLER, E.R.	
		GREGORY, J.C.	(UAH)
ZWIENER, J.	EH15	Fluorescence Measurements of the Thermal Control Coatings on LDEF Experiments S0069 and A0114. For presentation at the Second LDEF Postretrieval Symposium, San Diego, CA, June 1-5, 1992.	
HERREN, K.			
MOUNT, A.			
An Enhanced Whipple Bumper System: Impact Resistance of Composite Materials. For presentation at the AIAA Space Programs and Technology Conference, Huntsville, AL, March 24-27, 1992.			

## **APPROVAL**

### **FY 1992 SCIENTIFIC AND TECHNICAL REPORTS, ARTICLES, PAPERS, AND PRESENTATIONS**

Compiled by Joyce E. Turner

The information in this report has been reviewed for technical content. Review of any information concerning Department of Defense or nuclear energy activities or programs has been made by the MSFC Security Classification Officer. This report, in its entirety, has been determined to be unclassified.



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☆ U.S. GOVERNMENT PRINTING OFFICE 1993-733-050/80031









